19-549

FORESTRY ABSTRACTS

VOLUME VIII. 1946-47

Published by the
IMPERIAL FORESTRY BUREAU
OXFORD
1947

Printed in Great Britain at the Works of
W. HEFFER & SONS, LTD., CAMBRIDGE, ENGLAND

FORESTRY ABSTRACTS

VOLUME 8 1946 NUMBER 1

ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

01. BIBLIOGRAPHY. MATHEMATICAL AND STATISTICAL ANALYSIS

[1]. 01.6 (485). BJÖRKBOM, C. Register över Svenska Skogsvårdsföreningens publikationer 1920–1942. [**Index to the publications of the Swedish Forestry Association 1920–1942.**] Svenska Skogsvårdsföreningen, Stockholm. 1944. pp. 140. [Sw.]

Containing 3 indexes—(i) systematic by subject; (ii) author index to original articles; (iii) reviews, indexed according to original authors [reviews by subjects also included in (i)]—to *Svenska Skogsvårdsföreningens Tidskrift*, *Skogen*, and *Meddelanden från Statens Skogsförsöksanstalt*.

[2]. 01.7. BISTRUP, C. Tilnærmet Middelfejlberegning. [**Approximate calculation of the standard deviation.**] *Dansk Skovforen. Tidsskr.* 29 (4), 1944 (166–8). [Dan.]

With a normal distribution, use of the simpler formula $\sigma = \frac{\Sigma x}{N} \cdot \sqrt{\frac{\pi}{2}}$ gave a result differing by only -15 per mille from that obtained by the usual formula $\sigma = \sqrt{\frac{\Sigma (x)^2}{N}}$. A tabular comparison of the results given by the two formulae for irregular distributions (diameter in stands) shows coefficients of variation of 23·2 for the usual and 22·9 for the simplified formula. The latter is thus suitable for general use, especially as the correct formula itself, when used on an irregular distribution, gives a value that is only approximate.

02. HANDBOOKS

[3]. 02.2 (92 : 91.1 : 91.2 : 95). HONIG, P., and VERDOORN, F. (Editors). **Science and scientists in the Netherlands Indies.** Board for the Netherlands Indies, Surinam and Curaçao, New York City. 1945. pp. xxii + 491 + plates. Price $4.00 or £1 1*s*. 0*d*.

04. MAPS

[4]. 0.4 (51) TANG, Y., and KO, P. F. **Map showing Chinese main forest regions and lumber-markets.** *Spec. Bull. For. Prod. Lab., Kaiting, China* 1943. p. 1. [Chin.e.]

Abstr. in *Forest Products Laboratory: a brief account of its plan and works with abstracts of some publications* (*September* 1939-*December* 1944). National Bureau of Industrial Research, China.

Cf. *For. Abstr.* 8 (No. 36).

05. PERIODICALS

05.3. *Annual Reports*

[5]. 05.3 (489) : 09.4. DENMARK. Oversigt over de Danske Statsskoves Udbytte af Ved og Penge for Finansaaret 1939–40. [**Review of the timber and financial yields of the Danish State Forests for the financial year 1939–1940.** (Also corresponding reports for 1940–41, 1941–42, 1942–43, 1943–44 and 1944–45.)] Nielsen and Lydiche (Axel Simmelkiær), Copenhagen. 1941–46. pp. 12; 13; 14; 14; 14; 13 + 4 tbls. [Dan.]

[6]. 05.3 (492). HOLLAND. Verslag over den landbouw in Nederland over 1940. [**Report**

on agriculture in Holland for 1940. (Also succeeding report for 1941.)] *Verslagen en Mededeelingen van de Directie van den Landbouw* (Algemeene Landsdrukkerij, 's-Gravenhage). Nos. 2, 1943, pp. 224; 1, 1945, pp. 212. [Du.]

[7]. 05.3(492):94.1. HOLLAND. Jaarverslag van het Staatsboschbeheer over 1939. [**Annual report of the State Forest Administration, 1939.** (Also succeding reports for 1940, 1941, and 1942.)] Departement van Landbouw en Visscherij, Directie van den Landbouw. Algemeene Landsdrukkerij, 's-Gravenhage. 1940–43. pp. 89; 85; 57; 49. [Du.]

[8]. 05.3(66.9). NIGERIA. **Annual report on the forest administration of Nigeria for the period 1st January 1944 to 31st March, 1945.** Govt. Printer, Lagos. 1945. pp. 47.

[9]. 05.3(68.9). NYASALAND PROTECTORATE. **Annual report of the Forestry Department for the year ended 31st December, 1944.** Govt. Printer, Zomba. [1945]. pp. 12.

[10]. 05.3(71.11). ALBERTA. **Annual report of the Department of Lands and Mines of the Province of Alberta for the fiscal year ended March 31st, 1945.** King's Printer, Edmonton. 1946. pp. 155 + tbls.

[11]. 05.3 (73). UNITED STATES. **Forests and employment. Report of the Chief of the Forest Service [1944–] 1945.** U.S. Forest Service, Washington, D.C. 1946. pp. iii + 35.

[12]. 05.3(74.6). CONNECTICUT. **Connecticut Agricultural Experiment Station: report of the Director for the year ending October 31, 1944.** *Bull. Conn. agric. Exp. Sta.* No. 484, 1945 (55–103).

[13]. 05.3 (77 : 76). **Sixteenth annual report of the Central States Forest Experiment Station [for 1944].** Central States For. Exp. Sta., Columbus, Ohio. 1945. pp. 20.

[14]. 05.3(943). QUEENSLAND. **Report of the Director of Forests for the year ended 30th June, 1945.** Govt. Printer, Brisbane. [1945]. pp. 4 + tbl.

06. SOCIETIES. ASSOCIATIONS

[15]. 06.1(73). BUTLER, O. **The American Forestry Association.** *J. For.* 44 (1), 1946 (17–8). [American Forestry Association, Washington, D.C.]

A brief review of the work of the American Forestry Association since its foundation in 1875.

[16]. 06.1 (73). DOWLING, E. C. **The Charles Lathrop Pack Forestry Foundation.** *J. For.* 44 (2), 1946 (108–9).

A short account of the Charles Lathrop Pack Forestry Foundation, an endowed organization devoted to the promotion of educational and scientific work in the field of forestry. One of the present major undertakings of the Foundation is a joint study with the Society of American Foresters of state forestry administration. The Foundation's headquarters are at 1,214 16th Street, Washington 6, D.C.

[17]. 06.1 (73) : 11.62.11. FINK, O. E. **Friends of the land.** *J. For.* 44 (4), 1946 (285–6). [Friends of the Land, Columbus, Ohio.]

An account of the aims and activities of a society founded in 1940 to foster and encourage land conservation and to promote public interest in it, in the United States.

07. EDUCATION AND RESEARCH. MUSEUMS. COLLECTIONS. TOOLS

[18]. 07.1 (47.1). HEIKEL, A.-M. Speciallinjer inom den finska forstfakulteten. [**Specialized courses in the Finnish Faculty of Forestry (University of Helsinki).**] *Skogen* 33 (8), 1946 (129–30). [Sw.]

Dissatisfaction with the forestry training given at the University of Helsinki has led to the provision of 5 specialized courses: (i) General, with emphasis on silviculture and management. (ii) Peatland, to produce specialists on peatland and drainage problems. (iii) Technical, with emphasis on logging, extraction, etc. (iv) Economics, with branches for national economics, business economics and marketing. (v) Timber trade, etc. Courses (i)–(iv) lead to a grade equivalent to that of district forest officer, but this is not true of Course (v) unless combined with one of the preceding courses. The syllabuses for the first 4 courses have a great deal in common, e.g. silviculture, management, botany and chemistry are obligatory throughout, and in general the chief difference lies in the subjects for which honours are required. The studies last 4 years and no previous experience of practical forestry is demanded. Each year about 50 students pass out, including some women.

[19]. 07.1 (73). GUISE, C. H. **Statistics from schools of forestry for 1945: degrees granted and enrolments.** *J. For.* 44 (2), 1946 (110–4). [Department of Forestry, Cornell Univ., Ithaca, N.Y.]

[20]. 07.1 (73). **Where do our Forestry Schools fail?** *J. For.* 44 (3), 1946 (173–5).

An analysis of some of the weaknesses in instruction in Schools of Forestry in the United States, by eleven graduate foresters serving with American forces in Europe. They consider the principal weaknesses to be:—

(1) Lack of a sufficiently broad educational background in forestry curricula (e.g. a grounding in economic geography, history, foreign languages might be taken: every forester should have a thorough grounding in English, technical report writing and public speaking). (2) Too much inferior teaching. (3) Failure to obtain students of the best type and insufficient weeding out of misfits. (4) Insufficient guidance of students in the choice of courses, etc. (5) Insufficient development and use of field training. (6) Over-emphasis on civil service examinations.

[21]. 07.2 (43.1–5). SAEMAN, J. F., LOCKE, E. G., BUNKER, H. J., and CAMPBELL, W. G. **Report on visit to the Reichsinstitut für ausländische und koloniale Forstwirtschaft, Reinbek-Hamburg.**, *Final Report, Brit. Intell. Obj. Sub-comm.* Item 22, No. 135. 1945. pp. 6 + 6. P.R.

This Institute was used before and during the war for training in all branches of forestry, wood anatomy, minor forest products, wood chemistry including the chemistry of pulp and paper, timber mechanics, etc., and carried out research in these subjects with particular reference to timbers growing in Africa and South America. Brief summaries of the activities of the Institute from 1939 to the end of hostilities are given.

[22]. 07.2 (43.1–5) : 35 (4) : 33.15 : 01.2. FLEISCHER, H. O., and SEBORG, R. M. **Report on Research Institute for World Forestry and Silviculture (Staatliche Forschungsanstalt für Weltforstwirtschaft und Bodenkultur).** *Combined Intelligence Objectives Subcommittee* Item No. 22, File No. xxxi-74. [H.M. Stationery Office, London], 1945. pp. 7 + 7 + 17 + 20.

A report on the Staatliche Forschungsanstalt für Weltforstwirtschaft und Bodenkultur (Franz Heske, Director) at Reinbek-Hamburg made in June, 1945, on behalf of the U.S. Technical Industrial Intelligence Committee This Institute was concerned with anatomical, mechanical and chemical properties of wood, and particularly with the utilization and silviculture of African forests, from which it was hoped to supplement the European shortage of timber. There is an extensive collection of specimens and microphotographs of tropical woods, the African series being almost complete and ready for publication.

Work has been done on the manufacture of paper by mixing, in various proportions, several species of tropical woods which have fibres of various structures [e.g. *Lophira*, *Musanga smithii*, Balsa (*Ochroma*)]. This is claimed to be an entirely new theory in paper making but is an expensive process.

Appended is a report in popular style on the forestry problems of the British Occupation Zone and a more technical and statistical review of post-war timber supply problems in Europe. The Institute is likely to be allowed to continue to function.

[23]. 07.2(54):06.2. INDIA. **India: resolutions passed at the Sixth Silvicultural and the Senior Officers' Conferences held at Dehra Dun in April, 1945.** *Emp. For. J.* 24 (2), 1945 (214–20).

Resolutions were passed on post-war silvicultural research, the effect of war on silvicultural and yield prescriptions of working plans; the efficiency of enumerations [cf. *For. Abstr.* 7 (Nos. 1432, 2090–2); 8 (Nos. 739–40)]; natural and artificial regeneration of Teak [cf. *For. Abstr.* 7 (Nos. 1717, 1720, 1752, 1754)]; the afforestation of dry areas [cf. *For. Abstr.* 8 (No. 256)]; grazing and pasture research. It is recommended that investigations and tours to study the following subjects should be made as soon as possible: regeneration of Fir forests; efficiency of enumerations; control and fixation of sand drift; species suitable for the afforestation of arid and desert regions, including the varieties of *Prosopis juliflora*; regeneration of Salai (*Boswellia serrata*) forests; *de novo* regeneration of Sal (*Shorea robusta*); *Casuarina* plantation technique; quick-growing broadleaved trees of industrial value; timber species suitable for dry areas both with and without irrigation.

[24]. 07.2 (71). McElhanney, T. A. **Program of work 1946–1947.** Forest Products Laboratories, Dominion Forest Service, Canada. [1946.] pp. [88]. P.R.

The programmes of the Forest Products Laboratories of Canada were suspended during the war. The new programme for 1946–47 includes, therefore, some projects begun before the war. Others were begun during the war and are of continued interest in peace-time or were suggested by intensified war research. New projects accumulated during the war are also included. All projects are set out in full in the programme.

[25]. 07.2 (71.3). Leslie, A. P. **Forest secrets sought by research.** *Sylva, Toronto* 1 (2), 1945–46 (15–9).

A short survey of the research activities of the Ontario Forest Department.

[26]. 07.2 (75 : 76). Connaughton, C. A., and Haig, I. T. **Forest research in the South being expanded.** *Sth. Lumberm.* 171 (2153), 1945 (129–33).

Congress in 1945 appropriated a sum of $300,000 for expanding the Federal forest research programme in the South, the funds being made available to the Southern Forest and Appalachian Forest Experiment Stations. A system of field work centres is being established from Virginia to Texas in accordance with a long-standing, comprehensive plan of research. A brief account is given of the type of work which will be carried out at each forest research station.

[27]. 07.5 (42.1–8). Melville, R. **Timber trees and research at Kew.** *Off. Archit.* 9 (2), 1946 (92–3). P.R.

A description of some of the species of trees, their wood and examples of their utilization, to be found at Kew Gardens, in the attached Museums and at Bedgebury, the new national pinetum. A brief account is also given of the research at the Jodrell Laboratory and the main Herbarium at Kew.

[28]. 07.7 : 23.24.2 : 32.91.12 : 23.22.1 : 23.23.13. Nye Redskaber til Skovbrug. **[New forestry implements.]** *Dansk Skovforen. Tidsskr.* 28 (7), 1943 (315–24). [Dan.]

Includes figures and descriptions of: (i) A tubular planting tool designed for lifting 1- to 2-year Beech wildings with a cylindrical 'ball' and for making planting pits of the same size to receive the ball-plants. Root damage is probably negligible, thus planting might be possible throughout the summer. (ii) A simple skidding drum of wooden construction, to facilitate manual dragging of long logs up to about 15 cm. in diameter. (iii) A 2-horse, toothed-disc harrow suitable for preparing strips for sowing. (iv) A hand screening machine for cleaning acorns, with an upper screen of 1·3-cm. mesh and a lower of 0·5-cm. mesh.

09.1. *Forest History*

[29]. 09.1 (489) : 12.19. Hansen, E. Historiske Optegnelser om Trævæksten paa Bornholm. [I. and] II. **[Historical notes on the trees of Bornholm. [I. and] II.]** *Dansk Skovforen. Tidsskr.* 28 (1; 5; 6), 1943 (11–22; 195–230; 237–65). [Dan.]

[30]. 09.1 (489) : 12.25. Lorenzen, P. Rømers Ædelgraner paa Bornholm. En Efterskrift. **[Rømer's Silver Firs on Bornholm. A postscript.]** *Dansk Skovforen. Tidsskr.* 28 (6), 1943 (266). [Dan.]

09.2. *Pre-history*

[31]. 09.2 : 12.25 (469). Teixeira, C. Pinheiro fóssil do Pliocénico de Rio-Maior. **[Pliocene fossil Pine of the Rio-Maior.]** *Bol. Soc. broteriana* 19 (2 ser; pt. i), 1944 (201–8 + plates). [Port.]

Pinus praepinaster (sp. nov.) allied to *Pinus pinaster*. [Cf. *For. Abstr.* 8 (No. 115).]

[32]. 09.2 (54.6). **Fossil floras of the Karewa series.** *Nature, Lond.* 157 (3989), 1946 (491).

The Karewa series of Kashmir were laid down in an ancient lake and are now exposed on hill sides and in the valley at elevations of 5,500–10,600 ft. The flora is rich, including many dicotyledons (mostly hill trees and shrubs), monocotyledons (mostly lowland aquatics), gymnosperms, and abundant algae. The age of all these fossiliferous deposits is regarded as lower Pleistocene, but there appear to be at least three separate floras, two tropical or subtropical and a third temperate flora which may belong to a different interglaciation. [Cf. *For. Abstr.* 7 (Nos. 1034–5).]

[33]. 09.2 (79.4 : 79.5) : 12.19.1. Chaney, R., Condit, C., and Axelrod, D. I. **Contributions to paleontology. Pliocene floras of California and Oregon.** *Publ. Carneg. Instn.* No. 553, 1944. pp. vii + 407 + 64 plates + tables.

Detailed information is given on the composition and distribution, both geographic and stratigraphic, of 10 floras ranging in age from transitional Mio-Pliocene to Upper Pliocene. A final chapter summarizes the relationships of these floras to one another, and to 22 other floras of the same approximate age in the western United States.

09.4. *Forest Statistics*

[34]. 09.4 (489). Hugsten i Skove og Plantager i 1938–39. **[Fellings in the forests and plantations, 1938–39.]** *Dansk Skovforen. Tidsskr.* 25 (11), 1940 (601–3). [Dan.]

[35]. 09.4 (489):05.3. DENMARK. Oversigt over de Danske Statsskoves Udbytte af Ved og Penge for Finansaaret 1944–45. **[Review of the timber and financial yields of the Danish State Forests for the financial year 1944–5.]** Nielsen & Lydiche (M. Simmelkiær), Copenhagen. 1946. pp. 13 + 4 tbls. [Dan.]

Fellings for the year totalled 520,262 cu.m., of which 370,939 was derived from the State Forest Districts proper, 136,228 from the heath forests and not fully productive Districts, and 13,095 from Jægerborg District. Total fellings by species, in cu.m., were: Oak 22,417; Beech 217,305; conifers 251,320; miscellaneous hardwoods 29,220. Fellings, in cu.m. per ha. of land actually under forest, were 11·7 in the State Forest Districts proper, 5·3 in the heath and not fully productive forests, and 9·9 in Jægerborg District. Disregarding the last-named, about 48 per cent. of the cut was timber and about 51 per cent. was derived from thinnings. Fellings were about 33 per cent. above the normal possibility and the growing stock is estimated to have been reduced to an average of 120 cu.m. per ha., which is believed to be lower than that in comparable private forests. The total area of all groups of State forest listed was 75,860 ha., of which 58,659 were under forest. About 75,000 tons of peat were produced, or about 10,000 tons more than in the previous year.

[36]. 09.4 (51). TANG, Y., WANG, K., and CHEN, T. C. **Table of estimated Chinese forest resources.** *Spec. Bull. For. Prod. Lab., Kaiting, China* No. 38, 1943. p. 1. [Chin.e.] *Abstr.* in *Forest Products Laboratory: a brief account of its plan and works with abstracts of some publications* (*September* 1939-*December* 1944). National Bureau of Industrial Research, China. 1945.

The table summarizes the statistical results of the preliminary survey on Chinese forest resources under the headings of region, location, transport, main commercial timber, approximate forest area, total standing timber, estimated annual output, main timber market, and accessibility. A conservative rough estimate of Chinese forest area is 555,009 sq. km., or 135,725,408 acres. About one-half of this area may be regarded as accessible. [Cf. *For. Abstr.* 8 (No. 4).]

[37]. 09.4 (6). **International yearbook of forestry statistics. Vol. III, Africa.** With supplement. International Institute of Agriculture, Rome. 1942–3. pp. xiii + 473 + map. [E.F.]

The first part of this volume deals with the forests of Africa and their production, the second with the imports and exports of timber and other wood products registered by the countries of that continent. The available statistical data relative to forests and wood production not only are generally scarce and largely approximate, but may often lead to confusion and erroneous comparisons owing to the non-comparability of figures published by forestry authorities in different countries, particularly in respect of what is included in the definition of forest. Moreover, useful species are often sparsely scattered over vast areas of close forest, and when they have been cut down these forests do not offer any further possibility of economic exploitation for the time being. Again, many large areas of forest are too far from means of communication to make their exploitation profitable. In all these cases, the simple indication of the area covered with forests is not of any great value unless at the same time the area of workable forest is indicated. The difference between the two figures may be very great, e.g. for Nigeria and Cameroons the total forest area is given as 60,345,900 ha. of which only 13,726,700 ha. are merchantable forests. It has, accordingly, been considered necessary in this publication to supplement, or, in many cases, replace, statistical documentation by brief descriptive and explanatory notes.

The chapter devoted to each country begins with an indication of the area of forest, followed, in most cases, by a note on topography and biotic, historical, and edaphic influences. Then follow information on forest types according to the most widely accepted classification, and notes on forest destruction, conservation, re-afforestation and ownership. Data on production are almost entirely lacking and, where they do exist, usually refer only to cuts executed by contractors under the control of forestry authorities. In some cases it has been possible to make rough estimates of both European and native consumption. Notes are given on the most valuable species in each country. The sources of information are given in a bibliography at the end of each chapter.

The second part of the book contains the statistics on the international trade in wood during the years 1930 to 1939 for all but a few countries of Africa. All figures of weight or volume have been reduced to metric tons or cubic metres; the value of exports and imports is given in the currency of the country concerned. Finally, a series of tables gives details of the countries of origin of imported woods and countries of destination of exported woods for such countries and categories of wood as are of particular interest from the point of view of international trade. *From authors' introduction.*

[38]. 09.4 (6). AARTSEN, J. P. VAN. **Statistics on African forests and woods.** *Repr.* from *Int. Rev. Agric.* 34 (2), 1943 (68S–88S).

An article based on the International Yearbook of Forestry Statistics, Vol. III, Africa [see preceding abstract].

[39]. 09.4 (73). WOODS, J. B. **More standing timber than generally supposed.** *W. Cst. Lumberm.* 72 (12), 1945 (89, 113).

An estimation, in very general terms, of the forest resources of the U.S. according to data collected by a private undertaking, the Forest Resource Appraisal.

[40]. 09.4 (75.5 : 75.6 : 75.7). CRUIKSHANK, J. W., and EVANS, T. C. **Approximate forest area and timber volume by county in the Carolinas and Virginia.** *For. Surv. Release Appal. For. Exp. Sta.* No. 19, 1945. pp. 17.

[41]. 09.4 (75.6). CRUIKSHANK, J. W., and TOLER, A. D. **North Carolina forest growth and drain, 1937–43.** *For. Surv. Release Appal. For. Exp. Sta.* No. 18, 1945. pp. 36.

[42]. 09.4 (75.7) : 35. LOTTI, T., and TODD, A. S. **South Carolina forest growth and drain, 1936–43.** *For. Surv. Release Appal. For. Exp. Sta.* No. 20, 1945. pp. 42.

[43]. 09.4 (79.3). [FREECE, H. J.] **Timber resources of Nevada.** *Timberman* 47 (2), 1945–46 (117).

[44]. 09.4 (79.5). WOODS, J. B. **Oregon's unequaled forest capital.** *Amer. For.* 52 (3), 1946 (122–4, 128, 140–2).

A preliminary report on the findings in Oregon of the Forest Resource Appraisal of the American Forestry Association. The total forest area of the State, once about 33 million acres, is now estimated at 29,107,740 acres; of this 48 per cent. is of the Ponderosa Pine type and 52 per cent. Douglas Fir type. Ownership is shown in the following table:—

	Eastern Oregon (Pine type)	*Western Oregon (Douglas Fir type)*
Federal ownership (including Indian lands and national parks) .	8,191,445	7,468,725
State ownership .	49,170	463,610
County and municipal ownership . .	81,695	545,195
Private ownership .	3,433,295	6,544,915
Total . .	11,755,605	15,022,445

The volume of commercial sawtimber available for harvesting, in 1,000 bd. ft., log scale, Scribner rule (hardwoods and Pines over 11 in. d.b.h., other conifers over 15 in. d.b.h.) is as follows:—

Eastern Oregon	73,582,822
Western Oregon	261,259,357

Reserved commercial timber, unavailable for harvesting—

Eastern Oregon	3,243,906
Western Oregon	1,748,674

It is estimated that 90 per cent. of the wood now being cut and sawn in Oregon for commercial use is logged in conformity with the State Forest Practices Act. Two-thirds or more is produced by firms which intend to stay in the business permanently by growing timber. Annual production is more than 6 billion bd. ft. Although there are vast areas of virgin forest where current growth barely exceeds decay, the annual increment is estimated at 634 million cu. ft. of wood, of which 1,680 million bd. ft. is sawtimber.

[45]. 09.4 (83). Briegleb, P. A., and Haig, I. T. **The forest resources of Chile.** *Agric. in Americas* 4 (12), 1944 (223–6, 234–5). A.P.B.

The predominantly (93 per cent.) hardwood forests of Chile cover 39,500,000 acres (22 per cent. of its area). The sparsely inhabited desert area to the north supports only a few tree species in watered plantations or as rare patches of scrubby growth of *Prosopis tamarugo*, *P. juliflora*, and *Cordia decandra*. Southward, as the rainfall increases, *matorral* or thicket composed mainly of evergreen hardwoods such as *Acacia cavenia*, *Boldoa boldus* and *Cryptocarya rubra*, covers wide areas. In the coastal cordillera and main cordillera of the Andes the original forest over large areas remains essentially undisturbed. The trees of this high forest are typically Chilean and include species of *Nothofagus*, *Laurelia*, *Aextoxicon*, *Eucryphia*, *Persea*, and *Weinmannia*. South of Puerto Montt the forest again becomes lighter and is interspersed more frequently with scrubby woodland and unforested areas.

There are about 350,000 acres of planted forests in Chile, of which roughly 60 per cent. consists of *Pinus radiata*, 30 per cent. *Eucalyptus globulus*, 4 per cent. *Populus nigra* var. *italica* and the remainder miscellaneous species.

Chile's domestic consumption of forest products is comparatively light, but the forests support a relatively large industry which uses almost 196,000,000 cu. ft. of timber annually. Sixty-one per cent. of this timber comes from the natural forest as against 27 per cent. from plantations and 12 per cent. from the woodlands. Fuelwood depletion is particularly high because of the shortage of other combustibles.

Fire is said to destroy annually nearly four times the amount of timber that is cut for use. However, the forest situation in Chile is a promising one so far as the character and quantity of timber is concerned. [Cf. *For. Abstr.* 7, 1945 (No. 541).]

09.7. *Monographs of Individual Forest Regions*

[46]. 09.7 (42.1–8) : 12.26–8 : 22.23. **Burnham beeches.** *Wood* 11 (3), 1946 (86–8).

The Burnham Beeches in Buckinghamshire are 285–375 years old and were pollarded at about 35 years old, probably to supply house fuel. Evidence from growth rings suggests that they were regularly lopped on a 12-year rotation until coal became plentiful and cheap. Photographs illustrate the very large trunks, many of which are composite, owing to natural grafting of adjacent trees, stimulated by pollarding.

[47]. 09.7 (44). Dupuy, J. Les forêts dans la région sous-pyrénéenne de Sauveterre. **[The forests in the sub-pyreneean region of Sauveterre.]** *Rev. géogr. Pyrenées* 15 (1–2), 1945 (106–17). [F.] O.G.

The history, present state, and system of management of these forests (mainly of Oak and Beech) are described. It is concluded that, in order to bring them into a prosperous state, the first needs are a system of forest roads, and a market for Beech, backed up by selection cutting and thinning at pole stage.

[48]. 09.7 (52) : 3 : 90. Sparhawk, W. N. [Compiler]. **Japan. Forest resources, forest products, forest policy.** U.S. Forest Service. 1945. pp. iii + 89.

A comprehensive survey of Japanese forests and forestry, upon which the economy of Japan is still largely dependent. The extent and character of the forests of Japan and her territories are discussed, and the numerous tree species listed and described in an appendix; about three-fifths of the forests are publicly owned. The volume of standing timber in the Japanese Empire in 1933 is estimated at 42,086 million cu. ft. (softwoods), and 45,789 million cu. ft. (hardwoods). Pre-war timber consumption in Japan proper is roughly estimated at 610 to 730 million cu. ft. (round volume), 3·44 to 4·16 billion board feet (sawed lumber) and 1,800 to 2,000 million cu. ft., probably stacked measure, (firewood and charcoal). Japanese forest industries, such as pulp, veneer and plywood, charcoal, etc., forest management, policy and administration are dealt with. The present programme of forest administration began less than 75 years ago, when forests were classified, ownership established and public forest administration organized. An appendix gives the text of the Revised Forest Act of 1911. Japan's self-sufficiency in timber in the past and her outlook for the future are also discussed.

[49]. 09.7 (71) : 12.25. Duchayfour, P. Notes sur la forêt canadienne. **[Notes on the**

Canadian forest.] *Ann. Éc. Eaux For. Nancy* 8 (1), 1941 (1–80). [F.]

After a short general account of the geological history and broad natural regions of Canada, the writer deals in some detail with the forest geography (1) of the East of Canada (Quebec and Ontario), (2) of British Columbia and the Rockies. Separate studies are devoted to the principal species (*Abies grandis*, *Chamaecyparis nootkatensis*, *Picea canadensis*, *P. engelmanni*, *P. mariana*, *P. sitchensis*, *Pinus banksiana*, *P. contorta* var. *murrayana*, *P. resinosa*, *P. strobus*, *Pseudotsuga taxifolia*, *Thuja plicata*, *Tsuga heterophylla*), under the heads: botanical characters, silvicultural characters, distribution, types of stand, quality of wood and utilization.

[50]. 09.7 (71.4) : 21 : 11.3. LEPAGE, E. Regards sur la forêt du Nouveau Québec. **[Observations on the forests of New Quebec.**] *For. québec.* 11 (2), 1946 (123–31). [F.]

These notes record observations made by the author in the course of the last three summers in northern Quebec. It was noted in 1895 that forest extended as far north as the 54th parallel of latitude but that at least half of it had been destroyed by fire. The situation seems to have deteriorated since then, at any rate in the Rupert River region. The deforestation caused by periodic fires is never made good by natural reforestation, which is extremely slow once the thin surface layer of humus has disappeared. North of 54° forest disappears altogether from the heights and becomes more and more scattered as one advances towards the north. Between 56° and 57° there are only occasional groups of trees meriting the name of forest, and no trees are found north of 58°.

Of the factors which influence the distribution and normal growth of a tree in the far north, the writer considers soil to be by far the most important. Black Spruce and Larch will withstand very adverse conditions of climate, altitude, aspect and drainage provided that they have a suitable soil. Even the Poplar can live far north on the clayey soils which it prefers. North of 58° there are no true soils since the intense cold inhibits the activity of the micro-organisms which form humus. Altitude and aspect also influence the growth of trees, but the second of these factors is more important than the first. Drainage is also important. The influence of the length of the vegetative season is still very obscure; possibly comparisons should be made on the basis of hours of illumination rather than number of days favourable to vegetative growth.

[51]. 09.7 (72 : 728 : 8). **Era of forestry ahead in other Americas: resources unsurpassed for lumber development.** *Sth. Lumberm.* 172 (2154), 1946 (38–42).

About 30 per cent. of the world's productive forest land is situated in Mexico, Central and Southern America, and the Caribbean Islands. The Amazon basin alone is said to hold the world's greatest reserve of forest wealth. About 6 per cent. of this land grows softwoods, about 8 per cent. temperate hardwoods, and the remainder is under tropical growth. Only 5 to 7 per cent. of the world's supply of sawn timber is being turned out from these huge areas of forest, owing to lack of transport facilities, fewness and smallness of sawmills, and ignorance of the types and uses of much tropical timber.

[52]. 09.7 (728.6) : 33 : 35 : 90. COSTA RICA. **The forests of Costa Rica: a general report on the forest resources of Costa Rica.** U.S. Forest Service. 1943. pp. [ii] + 84 + 48 + graph + map.

Agriculture is the principal industry of Costa Rica, and most of her manufacturing industries are associated with the processing of agricultural and forest products. About 20 per cent. of the area is agricultural, and the rest is in forests. The three principal forest types are: (1) evergreen rain forest; (2) deciduous forest; and (3) cloud forest. The forest flora is unusually rich, with more than a thousand species of trees, nearly 200 of which reach large size. Most of the cutting has been of a few speciality woods and in the main the forests are still virgin.

Logging, milling, and manufacturing facilities are comparatively primitive. The construction of the Inter-American Highway is opening up large forest areas hitherto inaccessible. Effective utilization of these and other areas depends upon more efficient extraction and processing and the development of markets for hitherto little-used woods. In order to make the forest resources a permanent asset to Costa Rica, a stable forest policy, implemented by a programme of conservation and development, is essential. Appendices deal with the common and scientific names, uses, strength, specific gravity, and other properties of the wood, lumber prices and exports of the more important species. There are 96 photographs of forests and forestry operations. [Cf. *For. Abstr.* 8 (No. 120).]

[53]. 09.7 (728.6) : 90. COSTA RICA. Los bosques de Costa Rica. Su área en el pasado y presente. **[The forests of Costa Rica. Their area, past and present.]** *Rev. Agric. S. José.* 17 (3), 1945 (111, 113, 115, 118–20, 122, 124–8). [Span.] Empleo futuro y manejo de los bosques de Costa Rica. Segunda parte. **[The future use and management of Costa Rica's forests. Part 2.]** *Rev. Agric., S. José* 18 (2), 1946 (75, 77–80). [Span.] A.P.B.

Translations from 'The Forests of Costa Rica: a general report on the forest resources of Costa Rica' published by the U.S. Forest Service. [See preceding abstact.]

[54]. 09.7 (73) : 11.6 : 9 : 4 : 6. BOERKER, R. H. D. **Behold our green mansions: a book about American forests.** The University of North Carolina Press, Chapel Hill. 1945. pp. xv + 313 + plates. Price $4.00.

The author's aim in this book was to present the facts of American forestry, avoiding controversial issues as far as possible and emphasizing the fundamental principles on which foresters are agreed. The public use of, interest in, and responsibility for the forests are particularly stressed and the problems of conservation are throughout kept in the foreground. There are nearly 100 pages of illustrations of forest types, silvicultural and utilization activities, industries and products, and many well designed to bring home to the general reader the effects of fire, flood and erosion, as well as scenic and recreational values. There are chapters on the following subjects: What is conservation?; forest resources of the United States; recreation for the people; relation of forests to wild life; forests and the water supply; holding the soil; forest and flood control; lumber and its by-products; the forest as a livestock range; forestry and agriculture; fire the destroyer; insect enemies; tree diseases and forest sanitation; leadership of the Federal Government; progress of the States in forest restoration; forestry problems in the South; community forests; economic factors in private forestry.

[55]. 09.7 (74.6) : 12.19.2 : 57. MEYER, W. H., and PLUSNIN, B. A. **The Yale Forest in Tolland and Windham Counties, Connecticut.** *Bull. Yale Sch. For.* No. 55, 1945. pp. 54 + plates + map.

This bulletin summarizes the past history of the area in general and the history of the forest in some detail, relates the impact of the hurricane of 1938, and describes present forest conditions, giving type areas, volumes and growth.

[56]. 09.7 (76.1) : 33 : 34. HARPER, R. M. **Forests of Alabama.** *Monogr. Geol. Surv. Ala.* No. 10, 1943, pp. 230.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.4. *Soil*

[57]. 11.4. HALL, A. D. **The soil: an introduction to the scientific study of the growth of crops.** New and revised edition by G. W. Robinson. John Murray, Albemarle Street, W., London. 5th ed., 1945. pp. xiv + 322 + plates. Price 9*s.*

Since the last revision of this work in 1931 important developments have taken place in soil science, and the whole book has accordingly been recast to give a restatement of the subject as it appeared in 1944. The new book has the following chapters: 1. Introductory; 2. The origin of soils; 3. Proximate composition of soils; 4. Structure and tillage properties of soils; 5. Soil moisture; 6. The temperature of the soil; 7. The chemistry of soils; 8. The living organisms of the soil; 9. Fertility and sterility of soils; 10. Classification and mapping of soils; 11. The analysis of soils.

11.41. Soil Physics

[58]. 11.41.3 : 07.7. **Soil moisture meter.** *Amer. Nurserym.* 83 (6), 1946 (22).

A portable instrument for accurately measuring the moisture in the soil available to plant life has been developed by J. T. Rhamstine, a manufacturer of electrical devices, of Detroit, Michigan. Operation is simple. The meter is checked for temperature before the soil test is made. The soil temperature is taken, and the search coil is then lowered to the bottom of the test hole. The reading obtained is directly converted on a chart to the available moisture in the soil. An important feature of the instrument is the fact that it does not make electrical contact in the soil. Some conductivity methods have been tried, but they proved unreliable in salt or acid soils.

11.43. Biology of Soil, including Mycorrhiza

[59]. 11.43 : 12.19.2 : 12.19.3 : 11.42. Richard, F. Der biologische Abbau von Zellulose- und Eiweiss-Testschnüren im Boden von Wald- und Rasengesellschaften. I. Methodischer Beitrag zur Bestimmung der biologischen Bodenaktivität nach dem sog. Reisstest. **[The biological decomposition of cellulose and protein test cords in soils under forest and grass associations. I. The method of determining biological soil activity by the so-called 'tearing' test.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 24 (1), 1945 (297–397 + plate). [G.g.]

A method for determining the degree of biological activity in a soil by measuring the amount of decomposition of cellulose and protein cords in a given period (as reflected in decrease of tensile strength) is described and critically discussed. Full consideration is given to the correlation between humus formation and environmental factors and to the methodical difficulties which arise in determining the influence of individual site factors on biological activity, which is of great importance in humus formation and in improving the structural properties of the soil. Comparative investigations were carried out in various soil layers in forest and grassland associations in Switzerland. The types sampled were located in (i) the brown earth series of the broadleaved forests (*Querceto-carpinetum aretosum, Q.-C. luzuletosum* and *Q.-Betuletum*; (ii) subalpine coniferous and meadow communities(*Pineto-Caricetum humilis, Mugeto-Ericetum caricetosum humilis, Rhodoreto-Vaccinietum cembretosum*); and (iii) subalpine dwarf shrub and meadow communities. The results are summarized in 59 numerical statements and 22 graphical diagrams.

[60]. 11.43.1 : 12.25 : 12.21. Ferreira dos Santos, N. Elementos para o estudo das micorrizas ectendotróficas do *Pinus pinaster* Sol. **[Contribution to the study of the ectendotrophic mycorrhizae of *Pinus pinaster* Sol.]** *Publ. Serv. flor. Port.* 8 (2), 1941 (65–95 + plates). [Port.port.e.]

Two fungi, *Boletus fragrans* Vitt. (?) and an unidentified species (named *Mycelium radicis pinaster*) were isolated from the roots of *Pinus pinaster*. Neither fructified in culture, even under optimum growing conditions; and at temperatures higher than 28° and 30° C. they ceased to develop. A few months after inoculation, the *Boletus* had formed a coralloid mycorrhiza with the roots of *Pinus pinaster*, but the other fungus had failed to produce any mycorrhiza. A histological study of the *Boletus*-inoculated material confirmed the existence of a mycorrhizal formation and revealed marked variation from the normal in the structure of the infected roots.

[61]. 11.43.1 : 23.24.1 : 12.25 : 23.26 (485). Björkman, E. Om skogsplanteringens markbiologiska förutsättningar. **[Forest planting and soil biology.]** *Svenska SkogsvFören. Tidskr.* 42 (5), 1944 (333–55). [Sw.e.]

Reasons for the often very poor results of conifer plantings in Norrland include inadequate care of the plants, use of stock of unsuitable provenance, drought and diseases. A further important reason appears to be neglect of mycorrhizal relationships. In medium-good and rather poor soils, Scots Pine and Norway Spruce usually have an extensive root system which is for the most part mycorrhizal and thus better able to utilize available nutrients. On rich soils, e.g. mulls, the root systems are normally more compact, development of mycorrhizae is weak, and root hairs or possibly pseudomycorrhizal roots are the chief means of nutrient uptake. A special problem of Norway Spruce, apparently connected with root development, is its tendency on poor soils to stagnate for the first 10–20 years and then begin to grow normally. Roots of stagnating plants were found to have few or no mycorrhizae, whereas more vigorous plants of the same age and in the same vicinity showed comparatively good mycorrhiza. Spruce has been found to develop mycorrhiza with greater difficulty than Scots Pine and with much greater difficulty than Mountain Pine, which may possibly throw light on the favourable influence of the last-named on the growth of Spruce, as observed by Müller. Mycorrhizal plants of Scots Pine, when planted in sterile peat of low phosphorus content, grew in one summer to double the size of non-mycorrhizal stock brought (by addition of nutrients) to the same size at planting time and planted in the same medium. Mycorrhizal plants thus appear better able to utilize the little phosphorus present in such a medium. Scots Pine plants grown in forest soil and having abundant mycorrhiza failed or showed poor growth, discoloration of needles, and poor root systems with deteriorating mycorrhiza when transplanted to a heavily fertilized garden soil, whereas controls transplanted to an unfertilized garden soil showed normal growth and generally good mycorrhizal development. All forest planting, involving a transfer to a new environment, implies a strain on the nutrition balance of the plants; hence it is important to treat nursery stock in such a manner that the root system develops in the same way as would be natural in the soil where plantings are to be made. In rich forest soils, e.g. in southern and central Sweden, it is possible to plant out strong, heavily fertilized, more or less non-mycorrhizal stock, whereas in poor soils, e.g. in Norrland, mycorrhizal stock raised with little or no fertilizer should be employed. It is probably a good plan to lay out nurseries, so far as possible, on the felling sites or at least on the same soil type as that in which planting is to be done. [Cf. *For. Abstr.* 8 (No. 208).]

[62]. 11.43.1 : 23.24.1 : 12.25. Björkman, E. Skogsplantering ur näringsbiologisk synpunkt. **[Planting from the point of view of nutritional biology.]** *In* Skogsodling-Föredrag, hållna vid skogsodlingskursen å skogshögskolan den 23–26 april 1945. Svenska Skogsvårdsföreningens förlag [Stockholm]. 1945. pp. 79–87. [Sw.]

With particular reference to the role of mycorrhizal fungi, which in Sweden are likely to be absent or insufficient mainly in certain swampy areas, old heathland, and felling sites that have lain bare for many years. Mycorrhizal roots are not necessary to Pine and Spruce on soils rich in nutrients, particularly nitrogen and phosphorus; elsewhere they may be essential for growth. In 1944 1-year-old Pines of equal size, with and without mycorrhiza, were grown in fungus-free peat, some being watered with a nutrient solution containing no phosphorus, others with distilled water only. Mycorrhizal plants showed uniformly stronger growth than non-mycorrhizal. In the series given nutrient solution the mean dry plant weights, in mg., were 267·4 for non-mycorrhizal and 419·8 for mycorrhizal plants; the respective values for the series given only distilled water were 283·6 and 324·1. The dependence of the fungi on the trees seems to lie in the provision by the latter of soluble carbohydrates, particularly dextrose. Strangulated 3-year-old Pines, in which downward translocation of carbohydrates was interrupted, showed no mycorrhiza formation, whereas unstrangulated controls developed mycorrhiza in plenty. Recent work has shown that nitrogen and phosphorus supplies are two of the chief factors regulating the variation in mycorrhiza formation. Greenhouse experiments at Uppsala in 1941–42 showed that provision of either nitrogen or phosphorus alone had no very marked effect on mycorrhiza formation, but in the presence of both, mycorrhiza formation was almost completely inhibited. As a very general interpretation of such results, it is probable that where the presence of nutrients is sufficient for vigorous growth there is no surplus of sugars available for the fungus, as sugars are fully utilized by the host plant in growth processes. Mycorrhiza formation appears to be low on poor Spruce sites and Pine heaths with inactive mor humus, swamps, etc., increasing to a maximum in coniferous forest with active forms of raw humus and again decreasing through the better mull and hardwood sites. Not a great deal is known yet of the details of the relationships between soil nutrients and mycorrhizal development, but at present it seems best to use mycorrhizal nursery stock for poor sites where existing trees have mycorrhiza, and strong, more or less non-mycorrhizal, stock for the good sites where little or no mycorrhiza occurs naturally.

11.44. Surface Humus

[63]. 11.44 : 12.25. Lindberg, S., and Norming, H. Om produktionen av barrförna och dennas sammansättning i ett granbestand invid Stockholm. **[On the production of needle litter and its composition in a Spruce stand near Stockholm.]** *Svenska Skogsv-Fören. Tidskr.* 41 (4), 1943 (353–60). [Sw.sw.]

The production of needle litter in an old Norway Spruce stand was found to be, 3,089 kg. (dry weight) per ha. for a 1-year period. The mean composition of the litter, in per cent. of the dry weight, was: ash 8·40, N 0·962, SiO_2 3·29, Al_2O_3 0·046, Fe_2O_3 0·030, MnO 0·21, CuO 0·0013, CaO 2·01, MgO 0·218, K_2O 0·455, Na_2O 0·027, P_2O_5 0·158, Cl 0·07, SO_3 0·42. The composition of the litter varied, partly with season and partly with individual trees or groups of trees; all such variations, however, were very small, and less than variations due to site as evidenced by data from literature.

11.47. Maintenance of Favourable Soil Conditions

See also *For. Abstr.* 8 (Nos. 233, 253, 655, 658).

[64]. 11.47.1 : 23.26.4. Bornebusch, C. H. Gødskning af Planteskoler. **[Manuring of nurseries.]** *Dansk Skovforen. Tidsskr.* 29 (2), 1941 (49–55). [Dan.]

A review of three series of trials, using stable manure and balanced or unbalanced treatments with artificials, carried out by H. Sørensen (i) at Hornum, 1926–37, this series including the forest tree species Elm, Ash and Beech; (ii) at Hornum, 1936–42, including Mountain Pine, White, Sitka and Norway Spruces, Ash, Beech, and Hornbeam; (iii) at Blangsted, 1936–42, including Mountain, Scots and Austrian Pines, White, Sitka and Norway Spruces, Silver Fir, Ash, Beech, Hornbeam and Lime. In spite of inconsistencies in the results, probably due in part to the less exhausted soil at Blangsted, the following general tendencies may be noted: (*a*) Mountain Pine in no case gave a positive response to manures. (*b*) Scots Pine showed a slight positive response to stable manure at Blangsted. (*c*) Austrian Pine showed a positive response at Blangsted to both stable manure and artificials, the latter producing the greater effect without any indication of which nutrient element might be responsible for this. (*d*) White Spruce reacted positively to stable manure, but not to artificials. (*e*) Sitka Spruce gave a slight positive reaction to stable manure, but none or practically none to artificials. (*f*) Norway Spruce gave a considerable positive response to stable manure, and a smaller response to artificials, K and N having the greatest effect among the latter. (*g*) Ash gave a marked positive response to both stable manures and artificials, especially to N and more to K than to P; there was no consistent difference between its reactions to natural and artificial manures. (*h*) Beech consistently gave a positive reaction to stable manure and lower or adverse responses to artificials; in one series this species was damaged considerably by treatments including Chile saltpetre, while ammonium sulphate was less harmful. (i) Hornbeam reacted negatively to all fertilizers at Blangsted, but positively (and more strongly to stable manure) at Hornum. (*j*) Elm (in one series only) gave a strong positive response to stable manure and a less marked, though considerable one to artificials.

The only species to react to a degree comparable with that of agricultural crops under similar treatment were Ash, and to a smaller extent, Elm. On the whole, and for the conditions in question, stable manure was superior to artificials. Mycorrhizal species appear less responsive than non-mycorrhizal ones. Much more research is needed, but in the mean time organic manures, whether stable manures or composts, appear to be the most suitable for the purpose. [Cf. *For. Abstr.* 8 (Nos. 61–2).]

[65]. 11.47.1 : 23.27 : 07.7. Chadwick, L. C. **Fertilizing shade trees.** *Amer. Nurserym.* 83 (5), 1946 (13).

Report of a conference at Ohio State University on fertilizing shade trees. Various methods of injecting the fertilizer into the soil were described, including the Irish Aero-Fertil gun through which compressed air is discharged directly into the soil, fracturing it to the required depth, displacing the soil atmosphere with air containing a supply of oxygen, and correcting nutrient deficiencies by blowing fertilizer through the loosened soil. An experiment is being conducted at Ohio Agricultural Experiment Station on methods of applying fertilizers to increase the growth of trees. The trees were 1¾ in. in diameter when the test was started. In the following table of results the figures

Method	*Treatment*	*Increase*
Aero-fertil .	Air and fertilizer . .	1·03
Fertigator .	Water and fertilizer .	1·00
Crowbar . .	Fertilizer	1·04
Drilled holes .	,, ...	1·02
Surface . .	,, ...	1·18
Surface mulch .	Stable manure and fertilizer	1·49
	Control . . .	·55

indicate the increase in diameter in inches, breast high, from 1st May, 1941 to 16th November, 1944.

11.49. Soil Types

[66]. 11.49 (66.68). KILLIAN, C. Sols de forêts et sols de savane en Côte d'Ivoire. Leurs charactères pédologiques, chimiques, physiques et microbiologiques. **[Forest soils and savanna soils on the Ivory Coast. Their pedological, chemical, physical and microbiological characters.]** *Ann. agron.* 12 (4), 1942 (600–32). [F.] A.P.B.

A report on the preliminary results of the Scaëtta-Killian expedition of 1938–39 to the Ivory Coast. Climate appears to have no influence on the chemical characters of the soils; the content of phosphates is everywhere uniformly low and deficient in relation to basicity. Assimilable potassium is also deficient, but is more variable from place to place. There appears to be no correlation between assimilable potassium content and pH of the soil. Saline solutions are generally very much diluted, but soluble compounds continually re-form, the insoluble salts being rapidly broken down by hydrolysis on account of the humidity and high temperatures of the climate. Humus undergoes particularly intense degradation; components, even those such as lignin, which are resistant elsewhere, are rapidly broken up and do not accumulate. Such low values for lignin in the humic horizon are unknown in the temperate region, but are typical of many soils in the equatorial zone.

If the respiration curves of forest mull from temperate forest be compared with those of humus from Yapo on the Ivory Coast, their mean figures are almost identical, but their form is very different. In the rain forest, as in the savanna, they are more or less horizontal, whereas in temperate climates there are well marked maxima and minima corresponding exactly to daily fluctuations in meteorological phenomena. The microflora of these very humid equatorial soils is extremely sensitive to the least modification in its environment. When studying the normal metabolism of the bacteria of an equatorial soil, it is essential that measurements should be made *in situ*, as transport to the laboratory causes profound disturbance. This explains the erroneous deduction of Corbet, after making laboratory measurements, that the intensity of respiration of soils from Malayan rain forest was double that of European forests.

The numbers of bacteria present in equatorial soils are not necessarily greater than those in tropical or even in temperate zones, and the mean figures for all three types are almost identical. These figures depend much more on local edaphic conditions than on climate. There is, however, an important difference between the dry and humid zones of French Equatorial Africa in the matter of distribution of bacteria in the different horizons of the soil. In the dry zone the maximum concentration of bacteria is found in the surface layer, while in the equatorial climate it is found lower down. The organic surface layer, despite its shallowness, is biologically important, particularly in the savannas, where humus is subject to strong leaching and to destruction by fire. Humification is always poor in the savannas, and when these are brought under cultivation particular care must be given to the formation and conservation of humus.

11.6. *Hydrographical Conditions. Water and Soil Conservation*

See also *For. Abstr.* 8 (Nos. 555, 576).

[67]. 11.6. FIVAZ, A. E. **Forestry in soil and moisture conservation.** U.S. Soil Conservation Service. 1943. pp. 22.

A general account of the subject prepared for the use of Latin American students. It deals with purposes and methods of planting trees, either in woodland or in shelterbelts, for erosion control, etc., tending, thinning, and harvesting, fire-protection and grazing control.

[68]. 11.6 (68.9) : 12.19.2. KELLY-EDWARDS, E. J. **Forestry notes for conservation officers. I. Relation of forests to general conservation and to conditions in Southern Rhodesia.** *Bull. Minist. Agric. S. Rhod.* No. 1313, 1945. pp. 11. *Repr.* from *Rhod. agric. J.* 42 (4), 1945 (288–97).

[For Pt. II see *For. Abstr.* 8 (No. 164).]

In order to remove some of the misunderstandings prevalent with regard to the relation between forests and climate, the author briefly discusses the extent of forest influences on temperature, air humidity, rainfall, evaporation, water conservation, and soil erosion. The two major types of indigenous forest in Southern Rhodesia are the closed forest (comprising mountain forest and fringing forest, each consisting mainly of closely spaced evergreen trees) and the more widely distributed open forest which covers about 60 per cent. of the Colony. The open forest may be subdivided into several types characterized by the dominance of one or other of the following tree species: *Parinarium mobola, Uapaca kirkiana, Terminalia sericea, Acacia* spp., *Brachystegia randii, B. woodiana, Baikiaea plurijuga* and *Copaifera mopane.*

This open forest has no direct effect on the rainfall of the Colony but the presence of even scanty forest cover ameliorates temperature, lessens the form of wind, and consequently diminishes evaporation.

[69]. 11.6 (77) : 91.3 : 11.44. Barrett, L. I., Zon, R., *et al.* **Michigan's water problems; Water Conservation Conference, Jan. 28, 1944.** [Department of Conservation, Lansing, Mich.] 1944. pp. 118.

	Black Locust		*Sassafras*	
Age (years)	*Woods*	*Field*	*Woods*	*Field*
	Inches	*Inches*	*Inches*	*Inches*
0–10	1·64±0·41	1·84±0·17	1·79±0·20	1·07±0·18
11–20	2·14±0·24	1·36±0·19	2·45±0·24	1·34±0·20
21–40	1·70±0·23	1·02±0·13	2·89±0·27	1·26±0·19
All	1·83±0·13	1·41±0·10	2·38±0·14	1·22±0·10

L. I. Barrett, Director of the Central States Forest Experiment Station read a paper on forest litter and groundwater, to demonstrate that soil- and forest-conservation practices can contribute much to the recharging of groundwater supplies. At the Station, infiltration rates were studied on abandoned field soils and on the same soils under stands of Black Locust [*Robinia pseudoacacia*] and Sassafras [*Sassafras officinale*]; the above table summarizes the results in terms of infiltration per hour where rate of application was 5·08 in. per hour.

[Cf. *For. Abstr.* 7 (No. 562).]

Experiments under other types of forest cover show similar results. On Muskingum silt loam in Ohio, the infiltration rate under a 60-year-old natural stand of Pine was 700 per cent. greater than that on an exactly similar but unforested adjacent old field. Planted Pine stands in Ohio, varying in age from 12 to 59 years, showed an average infiltration rate over 13 times as great as that of adjacent cultivated fields. On the cherty soils of the Arkansas Ozarks, forested areas absorbed water 6·8 times as fast as did adjacent pasture. The Soil Conservation Service Experiment Station at Coshocton, Ohio, found that over a period of one year, forested land admitted over 6 in. more water to the deep soil than did cultivated fields (pp. 16–18).

R. Zon, Director of the Lake States Forest Experiment Station, read a paper on the general interaction of forests and water. Ten years of meteorological observations conducted at the Station in the Upper Peninsula of Michigan, showed that a northern hardwood forest lowers by several degrees the temperature of both the air and the soil inside the forest, and that the relative humidity of the air is, on an average, 3–10 per cent. (max. 12 per cent.) greater within the forest than outside. Wind movement in a broadleaved forest, particularly in summer, is often only one-third of that in the open. All these factors affect the loss of moisture from the soil through evaporation. At the La Crosse, Wisconsin Station a 6-in. rain fell continuously within a period of 24 hours; under forest, this entire rainfall was stored in the soil, while more than 2 in. ran off from fields under crops of corn (pp. 19–21).

[70]. 11.62 : 91.3. Munroe, G. **Stream flow and ground water protection forests.** *For. Chron.* 22 (1), 1946 (32–5). [Department of Natural Resources, Saskatchewan.]

The writer discusses some of the factors to be taken into account in managing forests for the purpose of maintaining streamflow and conserving water, and concludes that the necessary information which a manager should have of his area is (1) annual precipitation and its seasonal distribution; (2) the run-off characteristics of the draining streams; and (3) as much as possible of the topography and soil types with which he will be dealing.

[71]. 11.62 : 91.3 (494). Burger, H. Einfluss des Waldes auf den Stand der Gewässer. IV Mitteilung. Der Wasserhaushalt im Valle di Melera von 1934–35 bis 1943–44. [**Influence of woodland on the water régime. IV. The water régime in the Valle di Melera from 1934–35 to 1943–44.**] *Mitt. Schweiz. Anst. forstl. Versuchsw.* 24 (1), 1945 (131–218). [G.g.f.i.t.]

A report, complementary to those on the Sperbel- and Rappengraben [see *For. Abstr.* 6 (122)] on a catchment of 105 ha., between 962 and 1773 m. altitude, in Ticino. Afforestation was carried out from 1915 to 1934, and in 1944 only 14·6 per cent. of the area was under pasture or mowing grass, etc., 1·7 per cent. scree and detritus, and the remainder under young plantations, scrub, and Beech coppice. The soil is generally deeper and more permeable than that of the Emmental catchments but, as in the latter, pasture showed the greatest run-off. Of mean annual precipitation (2105 mm.) 30 per cent. was lost by evaporation and transpiration and 70 was streamflow: corresponding figures for Nov.–Apr. (736 mm.) were 21 and 79, and for May–Oct. (1369 mm.) 36 and 64 per cent. respectively. The recorded annual precipitation is believed to be 100–200 mm. below the true figure, hence evaporation and transpiration may amount to 34–38 per cent. Surface run-off, evaporation and tranpiration, and streamflow (both for storms and for continuous rain) were all lower than in the Emmental catchments. The amount of water-transported débris per sq. km. of catchment averaged 87 cu.m., annually, or roughly the same as in the Sperbelgraben. Owing to the more permeable soil and higher infiltration capacity than in the Emmental, there is more water available for subterranean flow, and streamflow is better sustained in dry periods. Streamflow in dry periods was more sustained after a wet period than after a single precipitation in the middle of a dry period. The flow subsided more rapidly in summer dry periods than in winter ones. The residual effects of previous precipitation were demonstrable for storms, continuous rain, and dry periods. Up to 500 mm. of precipitation, i.e. 500,000 cu.m. per sq. km. may be stored in the soil for considerable periods to the later benefit of springs and groundwater. Though it was possible to conclude that deforestation on the same scale as in the Valle di Melera would have had much worse consequences on other geological formations with less permeable soils, the data do not allow any conclusions on the influence of the young plantations on the water régime of the valley, partly owing to irregularities in precipitation, and partly to the fact that proof of such influences can be afforded only by simultaneous comparative studies of two neighbouring areas, e.g. the Sperbel- and Rappengraben.

[72]. 11.62.11 (54.5) : 24.5. **Reclamation and afforestation.** *Punjab For. Notes* No. 11, 1945. pp. 3.

Brief notes on the habitat, phenology, seed storage, silvicultural characters and artificial regeneration of *Holoptelea integrifolia*. Seedlings of *Pueraria thunbergiana* planted on the edges of a landslip in the Nurpur area proved a failure, but further trials with this species on better sites are recommended. Shelterbelts similar to those planted in the arid country of the Southern States of the U.S.A. should be tried in the Southern Punjab to improve farming conditions on the desert fringe. [Cf. *For. Abstr.* 8 (Nos. 256–7).]

[73]. 11.62.11 (61) : 97.1 : 12.11.22. **Survey of land resources in Tripolitania.** British Military Administration, Tripolitania. 1945. pp. 156 + maps.

The findings of the survey are presented in the form of a report and two maps. The evidence on which the report is based is presented in a series of annexures, one of which deals with the Olive and another with afforestation.

The natives of Tripolitania plant Olives by cuttings. These are placed in the bottom of holes about 3 ft. deep, and the holes are gradually filled with soil as the shoots grow up to the ground level. By this method the trees get a good start and come earlier into bearing than trees grown from seedlings.

Afforestation must usually be preceded by sand fixation. For this purpose the Italians planted a network of low, ground-level windbreaks, usually of dead growth and roughly in square formation over the whole area affected. These windbreaks were flexible and facilitated an even distribution of sand over the whole area. The most suitable plants were *Imperata cylindrica*, *Aristida pungens*, and *Artemisia* *variabilis.* Once the movement of sand had been arrested, the seeds of any plants likely to establish themselves were sown within the squares. *Ricinus communis*, *Retama raetam*, *Peganum harmala* and *Calligonum comosum* were the most successful in establishing themselves before the primary barriers had decayed. The ground vegetation is important and must be maintained until the young trees are established. Of the many varieties of trees tested, the most successful under these conditions were *Acacia cyanophylla*, *A. horrida*, *Tamarix articulata*, *Cupressus horizontalis*, *Pinus halepensis*, and *P. pinea*. By 1940, when Italy entered the war, about 2,000 ha. of dune country had been fixed and planted, and considerable areas of forests and plantations had been established. For the future it is recommended that afforestation should be closely coordinated with agricultural policy. For instance, there are considerable areas awaiting development for olive-oil production; other areas need fodder trees such as Carob (*Ceratonia siliqua*), *Prosopis*, and spineless cactus; and the indigenous trees such as *Pistacia atlantica*, *Acacia tortilis*, *Zizyphus lotus*, Tamarisks, and *Rhus oxyacantha* can be developed in the more arid regions to provide shade and shelter for livestock.

[74]. 11.62.11 (728.1). Erosión y deforestación en Panajachel, medidas para contrarrestarlas. **[Erosion and deforestation in Panajachel and methods of checking them.]** *Rev. agric., Guatemala* 1 (10/11), 1945 (546–53). [Span.] A.P.B.

Measures to check erosion and flooding due to excessive exploitation of the Pine (mainly *Pinus montezumae*) forest and bad methods of hill cultivation. These include contour trenching, planting of river banks with Willows and Eucalypts, and the establishment of forest nurseries for the supply of species needed in erosion control (Pine, *Eucalyptus*, Poplar, *Casuarina*, etc.).

[75]. 11.62.11 (79.4). GLEASON, C. H. **Directions for sowing mustard for erosion control in burned areas of Southern California.** *For. Res. Note Calif. For. and Range Exp. Sta.* No. 37, 1944. pp. 29.

This research note was prepared to aid Forest Service administrative officers in sowing mustard as a 'first aid' measure in the burned areas of southern California. The object is to provide an immediate soil-protecting cover in the burn in order to reduce erosion and surface run-off, lessen the silt in run-off waters, promote infiltration and hasten the restoration of normal conditions. The note is concerned only with times, methods, etc., of sowing (sowing from aircraft is recommended); technical aspects of the question will be discussed in another paper.

[76]. 11.62.11 : 11.47 : 12.19.4. WARNER, R. M. **Relation of vegetative cover to the plant growth conditions of eroded soils.** *Iowa St. Coll. J. Sci.* 20 (1), 1945 (101–53).

The relation of plant cover to certain growth conditions on eroded soils of south-eastern Iowa was investigated by utilizing two methods of approach. In the first, the relation of the plant cover changes to the conditions of the habitat was studied on a site where factor change was accelerated by basin-listing. In the second, this relation was studied in a series of plant communities representing stages in the secondary plant succession. Available moisture in the profiles, particularly in the surface 6 in. was consistently lowest in the weed stage, intermediate in the late grass stage, and highest in the Oak/Hickory forest stage. *From author's summary.*

12. FOREST BOTANY. TREE SPECIES

12.1. *General Botany*

12.11. Physiology. Reproduction. Growth

12.11.1. *Metabolism. Plant Constituents. Sap Flow. Growth Substances. Reserve Materials*

See also *For. Abstr.* 8 (No. 289).

[77]. 12.11.11 : 12.14.7. EULER, H. v., AHLSTRÖM, L., HÖGBERG, B., and PETTERSSON, I. Coenzyme, Enzyme, Wuchsstoffe und Reizstoffe in Pflanzenorganen. I. **[Coenzymes, enzymes, growth substances and stimulants in plant organs. I.]** *Ark. Kemi. Min. Geol.* 19A (4), 1945 (publ. 1944). pp. 15. [G.] L.S.

A report on the chemical composition of the pollen of various plant species, particularly Aspen (*Populus tremula*), Willow (*Salix* spp.) and Birch (*Betula pubescens*), under two main headings: (1) nutrients and metabolic substances (including phosphate, magnesium, boric acid, carbohydrate and protein) and (2) ergons and enzymes (including cozymase, desoxyribonucleic acid, carotin, carotinoids, flavonols, growth substances, stimulants and enzymes).

[78]. 12.11.11 : 12.26–8 (54). Damodaran, M., and Rangachari, P. N. **Pectin from Indian plant materials.** *J. sci. industr. Res., India* 4 (5), 1945 (298–300). [Univ. Biochemical Laboratory, Madras.] I.H.

The pectin content of some of the commoner Indian fruits and other plant materials was investigated. Contrary to previous reports, the seeds of *Tamarindus indica* contain no pectin.

[79]. 12.11.12 : 12.26–8. Johnson, L. P. V. **Physiological studies on sap flow in the Sugar Maple (*Acer saccharum* Marsh.).** *Canad. J. Res.* 23C (6), 1945 (192–7). P.R.

Sap flow from the stumps of Sugar Maples was over five times as great as that from the trunks of the same trees, which were detached in November, January and March. There was no consistent variation in the sugar concentration of sap samples drawn from stumps and trunks, but samples taken from points above girdles were consistently higher in sugar than those taken from below. Sap flow is attributed mainly to the activities of living cells, and it is suggested that the oxygen concentration of the sap and the release of hydrostatic pressure in tapped trees are related to cell activities. The beneficial effect of alternating cold nights and warm days on sap flow is attributed to an increase in availability of oxygen to the living cell through the agency of the relative solubility levels of oxygen in water at low and high temperatures. *Author's summary.* [Cf. *For. Abstr.* 8 (Nos. 608–10).]

[80]. 12.11.13. Stiles, W. **Respiration. II.** *Bot. Rev.* 12 (3), 1946 (165–204).

Supplement to article in *Bot. Rev.* 1, 1935 (249–68).

[81]. 12.11.14 : 12.25. Marshall, H., and Maki, T. E. **Transpiration of Pine seedlings as influenced by foliage coatings.** *Plant Physiol.* 21 (1), 1946 (95–101). [North-eastern Forest Exp. Sta., Philadelphia, Pa.] O.B.D.

The water loss of White Pine [*Pinus strobus*], Red Pine [*Pinus resinosa*], and Loblolly Pine [*Pinus taeda*] seedlings was determined gravimetrically during exposure to high temperature and low humidity. With ample moisture in the potting medium, the following results were obtained:—

Seedlings top-dipped in emulsions of lanolin or a commercial paraffin wax transpired during four days of exposure less than 40 per cent. as much as untreated seedlings.

Untreated seedlings failed to respond to a substantial rise in temperature on the fifth day of exposure with as large an increase in water loss as did coated seedlings. Although not demonstrated experimentally, this response is presumed to result from a severe moisture deficit created in untreated seedlings during the first four days of exposure.

On the basis of water loss per unit fresh weight, Red and Loblolly Pines transpired respectively only 68·7 and 79·7 per cent. as much as White Pine. The calculation of root volumes per unit fresh weight showed a closely similar relationship.

Regression equations demonstrated that water loss varies directly as the fresh weight of the seedlings within the range of the present data. *Author's summary.*

[82]. 12.11.15. Went, F. W. **Auxin, the plant-growth hormone. II.** *Bot. Rev.* 11 (9), 1945 (487–96). [California Institute of Technology.]

An enumeration of the main facts known about the structure and properties of auxins, including methods of quantitative analysis, chemical properties, auxin production by the plant, transport of auxin within living tissues, the interrelationships between auxin and other factors in hastening stem elongation, the possible rôle of auxin as a coenzyme in a dicarboxylic acid dehydrogenase in normal respiration, and the effect of auxin on root growth, bud inhibition, the initiation of roots on stems, the swelling, division and differentiation of cells and tissues, and parthenocarpy. A bibliography of 94 titles is appended. [Cf. *Bot. Rev.* 1, 1935 (162–82).]

[83]. 12.11.15 : 12.11.23. Ostrom, C. E. **Effects of plant-growth regulators on shoot development and field survival of forest-tree seedlings.** *Bot. Gaz.* 107 (2), 1945 (139–83). [Southern Forest Exp. Sta., New Orleans, La.] O.B.D.

Experiments at New Orleans in 1942–43, involving about 25,000 trees and several hundred feet of nursery bed, were undertaken to survey several potential applications to forest planting practice of the control of top development of seedlings by means of growth regulators. Seedlings of Red, Loblolly, Shortleaf, Pitch, and Table-Mountain Pines, Red Spruce, Tuliptree, and White Ash were treated in the nursery bed, before storage or before planting. Naphthaleneacetic acid, naphthalenemethylacetate, naphthalene acetamide, and mixtures of naphthalene compounds with or without indolebutyric acid were applied in various ways. Methods included dipping, soaking or spraying with water solutions and carrier emulsions of lanolin or commercial wax, and exposure to vapours of the compounds.

The prospects for use of growth regulators to prevent excessive top growth of coniferous seedlings in the nursery are not encouraging. The smaller foliage area of treated seedlings did not confer greater drought hardiness during the same summer. The primary limitation for use of growth regulators to restrict growth is the danger of killing some of the seedlings, but high concentrations afford one means of killing undesirable or excess trees.

The most promising application lies in the prevention of premature shoot growth of hardwood seedlings during long storage periods. The treatment of Pine seedlings with inhibiting concentrations of growth regulators just before planting offers no promise of increased field survival. Treated hardwoods exhibit a delay of about two weeks in shoot growth, and increased survival may be obtained by treatment with growth regulators before late planting, when premature shoot growth might result in low survival. *From author's discussion and summary.*

[84]. 12.11.15 : 12.11.23. MAKI, T. E., and MARSHALL, H. **Effects of soaking with indolebutyric acid on root development and survival of tree seedlings.** *Bot. Gaz.* 107 (2), 1945 (268–76). [Southern Forest Exp. Sta., Gulfport, Mississippi.] O.B.D.

Seedlings of Eastern Red Oak and Loblolly Pine were treated immediately before planting by soaking the roots for 24 hours (in addition to a 6-hour series for Loblolly Pine) in aqueous solutions of indolebutyric acid ranging in concentration from 2·5 to 160 mg. per litre. Root volumes were measured before planting and again when the seedlings were lifted at the end of the first growing season.

Consistent increases in root volume of Red Oak followed soaking in all concentrations of indolebutyric acid, and statistically significant increases occurred with concentrations of 40 mg./l. or more. A barely significant increase in survival followed treatment of Red Oak with 5 mg./l. On the other hand a marked and highly significant increase in mortality followed treatment with 80 mg./l. or more. The largest increases in root volume of Red Oak were associated with the largest increases in mortality.

Treatments generally increased the root volume of Loblolly Pine, although there was no consistent relationship between root volume and concentration. A marked increase in mortality of Loblolly Pine followed treatment with concentrations above 20 mg./l. *Authors' summary.*

[85]. 12.11.16 : 12.26–8. MILANEZ, F. R. Hemicelulose de reserva no embrião de '*Hevea brasiliensis*' Müll.-Arg. **[Reserve hemicellulose in the embryo of *Hevea brasiliensis* Müll.-Arg.]** *Rodriguésia* 9 (18), 1945 (43–59 + plates). [Port.port.]

Freshly cut sections of the embryo of *Hevea brasiliensis* show large crystalline masses (not present in the cotyledons or the endosperm) which can be characterized as hemicellulose.

12.11.2. *Propagation*

[86]. 12.11.21 : 12.11.3. ARNBORG, T. Ett par lyckade resultat av barkringning och strangulering. **[A few successful results from bark ringing and strangulation.]** *Skogen* 33 (5), 1946 (84–5). [Sw.]

Pine trees about 30 years old and 2–5 m. high were ringed in June 1943 about 1 m. above ground level (just beneath the lowest green branch) by making two semicircular incisions with a vertical interval of 5–6 cm. In October 1945, ringed trees yielded 0·73 and controls 0·35 litres of cones per tree: the seed yields, in kg. of seed per hl. of cones, were respectively 0·50 and 0·34 but the smallness of the sample does not permit conversion of these figures to figures for yields per unit area. Ringed trees were observed to have shorter vegetative shoots, yellower needles, and slightly smaller cones than unringed trees. Other experiments on bark ringing and strangulation of young trees of Pine and Spruce made by the Sällskap för praktisk skogsförädling [Society for Practical

Forest Improvement], gave similar results. A case is also quoted and illustrated of a forked Birch with two equally developed stems, one of which after strangulation grew more slowly but produced 450 male catkins, mostly in threes, in the next winter but one, as against only 6, mostly in twos, on the now taller, unstrangulated stem.

[87]. 12.11.22 : 12.11.1 : 12.14.5. OVERBECK, J. VAN, GORDON, S. A., and GREGORY, L. E. **An analysis of the function of the leaf in the process of root formation in cuttings.** *Amer. J. Bot.* 33 (2), 1946 (100–7). [Institute of Tropical Agriculture, Mayagüez, Puerto Rico.] O.B.D.

The combined action of auxin and factors coming from the leaves is essential for root formation in cuttings. The leaves exert their influence in the dark as well as in the light. In Red Hibiscus the root-forming factors of the leaves can be entirely replaced by sucrose and nitrogenous substances. Quantitative chemical analyses show that these substances are actually contributed to the cuttings by the leaves. It is concluded that the main function of leaves in the process of root initiation is to supply the cutting with sugars and nitrogenous substances, factors which may be termed nutritional. There is no *a priori* reason to postulate the production of a special root-forming substance such as 'rhizocaline' in the leaves of Red Hibiscus. After treatment with auxin in conjunction with leaves or with suitable carbohydrate and nitrogen sources, roots were found to originate in the secondary phloem in the ray parenchyma. *Authors' summary.* [Cf. *For. Abstr.* 7 (No. 599).]

[88]. 12.11.22 : 12.11.15. SØNDERHOUSEN, O. Aflægning og Stikning. [**Propagation by layering and cuttings.**] *Dansk Skovforen. Tidsskr.* 31 (2), 1946 (65–8). [Dan.]

A brief account is given of a method of vegetative propagation whereby fruit-tree stocks are planted out in rows in the nursery and cut back very early in spring to induce coppicing from the root collar, the shoots so formed being earthed up to promote rooting, after which they are detached and treated as cuttings. This method was tried with Myrobalan B (an East Malling stock). Normally, difficult material would undergo a treatment consisting of storage of the cuttings for a month or two in peat litter at about 5° C. (to promote callus formation and the development of root rudiments), followed by hormone treatment immediately before planting. The season was so advanced that only the latter treatment (with the synthetic proprietary substance Floramon at different concentrations) could be used. The hormone-treated material gave 75 and controls 55 per cent. rooted plants, and there was reason to believe that use of the first phase of the treatment would have given even better results. It is suggested that similar methods might be useful for forest tree species difficult to propagate vegetatively.

[89]. 12.11.22 : 12.25. GRACE, N. H., and FARRAR, J. L. **Vegetative propagation of conifers; XIV. Note on seasonal progress of rooting of Norway Spruce cuttings.** *Canad. J. Res.* 23C (6), 1945 (189–91). P.R.

Dormant Norway Spruce cuttings were placed in outdoor propagation frames in early November; 25 per cent. of the cuttings had callus formation by the end of the following June and 80 per cent. were rooted by mid-July. Percentage rooting increased gradually to the final average value of 95 per cent. in early September. In mid-July cuttings had initiated 72 per cent. of the final number of roots though there was a gradual increase until early September. Mean root length increased by over 400 per cent. during the 20 days from July 18th to August 7th, the subsequent rate of increase in root length fell to less than 50 per cent. for the following 23 days. By September 23rd root growth had ceased; 84 per cent. of the final value had been attained by the end of August. *Authors' summary.*

[90]. 12.11.22 : 12.26–8. LARSEN, C. M. Stiklinger af urteagtige Skud paa Rødder af Bævreasp og Graapoppel. [**Cuttings from herbaceous shoots on roots of Aspen and Grey Poplar.**] *Dansk Skovforen. Tidsskr.* 28 (3), 1943 (96–113). [Dan.] [Skovtræforædlingen, Arboretet, Hørsholm.]

Experiments at the Hørsholm Arboretum showed that, under good (greenhouse) conditions, small cuttings of the herbaceous shoots developing from root cuttings of Aspen and Grey Poplar would mostly give 80–100 per cent. rooting in 10–14 days. Much of the root material was 'pre-sprouted' (cut to 5-cm. lengths and laid for sprouting in moist peat litter in boxes in an unheated greenhouse), and in the case of Grey Poplar it appeared immaterial to the success of rooting whether cuttings were taken from pre-sprouted root cuttings or from those planted in the open. The Aspen was all pre-sprouted. The green cuttings were planted for rooting in gravel or a mixture of soil, peat-litter and gravel, in boxes in the greenhouse, and were subsequently transplanted to ordinary nursery soil in frames, where some shelter could be given for the first few days.

There was some individual variation in the ability of the initial root material to form shoots; further, Aspen gave on the whole more shoots per root cutting than did Grey Poplar. Age of parent tree had no apparent effect on rooting.

To produce the largest possible plants at the end of the first growing season, early collection of root cuttings and treatment to promote shoot development are desirable, and sprouting in the open is therefore not likely to be a suitable method of obtaining green cuttings. Experiments are, however, to be continued to determine the best time for taking root cuttings and to find the most favourable treatment, *inter alia* the possibilities of avoiding transplanting and the greenhouse stage in this method. [Cf. *For. Abstr.* 7 (No. 1600).]

[91]. 12.11.22:23.26:12.11.3. LARSEN, C. S. and MAGIUS, E. Podning og Okulering af Skovtræer. **[Grafting and budding of forest trees.]** *Dansk Skovforen. Tidsskr.* 29 (2), 1944 (25–48). [Dan.]

A general account, with directions for, and figures illustrating, the more useful types of grafting (on young nursery stocks, forced greenhouse stocks, and older trees in the forest) and budding, and notes on the care of the grafted material. Among the common Danish tree species, Ash is very easy and Larch easy to graft by any of the usual methods; Beech, Oak and the remainder of the common species have so far given the best results with forced greenhouse stocks, but success has been achieved in some instances with ordinary nursery stocks and on older trees *in situ.* The chief successes with the last-named method have been with Ash on stocks up to 15 cm. in diameter, Oak and Aspen on stocks up to 5–8 cm., and Larch on stocks of about 5 cm. in diameter. The chief use of grafting is for experimental purposes and for the establishment of seed plantations, as the process is too dear for the direct production of timber trees. Budding, however, is likely to offer more promise for the latter purpose. Success has been obtained in buddings of Oak by the use of self-adhesive cellophane to seal the wound. Preliminary results of Ash buddings appear very promising. [Cf. *For. Abstr.* 8 (No. 98).]

12.11.3. *Heredity. Breeding. Races and Questions of Provenance. Cytology*

See also *For. Abstr.* 8 (Nos. 174, 590).

[92]. 12.11.3. STOCKWELL, P. **Tree breeding.** *Timberman* 47 (4), 1945–46 (44–5, 52). [Institute of Forest Genetics, Placerville, Calif.]

An account of the founding, development and work of the Institute of Forest Genetics in Placerville, California. Some of the pieces of research done in the past or still in progress are mentioned. At present 17 hybrids are on hand at the Institute; three of these display hybrid vigour. One of them (Western White Pine × Eastern White Pine) increased in weight more than 3 times as fast as the fastest-growing parent (Western White Pine). It is expected that some of these hybrids will be suitable for reforestation work.

[93]. 12.11.3(489). LARSEN, C. S. Skovtræforædlingen 1939–42. **[Forest tree breeding [in Denmark] 1939–42.]** *Dansk Skovforen. Tidsskr.* 27 (10), 1942 (405–40). [Dan.]

[94]. 12.11.3 (489):23.26. BORNEBUSCH, C. H. Meddelelser fra Frøudvalget. Provenienѕgaranti for Planter til Skovbrug. **[Reports from the Seed Committee: provenance guarantee for forest planting stock.]** *Dansk Skovforen. Tidsskr.* 28 (3), 1943 (114–7). [Dan.]

The text is given of an agreement of 1943 between the Seed Committee of the Danish Forestry Association and 17 named nurseries, whereby the latter engage themselves to accurate booking of their stock, the furnishing of a certificate of provenance with stock sold, and to submit to periodical checking of their stock and books by an official of the Seed Committee. [Cf. *For. Abstr.* 7 (No. 1601).]

[95]. 12.11.3 (485). SYLVÉN, N., *et al.* Svensk skogsträdsförädling. Några riktlinjer i Föreningens för växtförädling av skogsträd arbetsprogram. **[Swedish forest tree breeding. Some general lines in the programme of work of the Swedish Forest Tree**

Breeding Association.] *Svenska Skogsv-Fören. Tidskr.* 42 (3), 1944 (204–17). [Sw.]

A general review, with emphasis on the cardinal importance of progeny trials. For poor seed yielders, e.g. the conifers, Oak, Beech and Ash, the practical application of breeding principles is envisaged as beginning with the simpler and less reliable methods, with progressive introduction of refinements as time and results permit; the possible phases being use of seed (i) from especially good stands; (ii) from stands known to produce good progeny; (iii) from seed plantations raised from seedlings from élite trees; (iv) from seed plantations derived by vegetative propagation from élite trees; (v) from seed plantations derived by vegetative propagation from mother trees known to produce good progeny; (vi) from seed plantations derived by vegetative propagation of parents known to give good progeny in controlled crossings. The abundant seed yielders, e.g. Aspen and Birch, offer fewer obstacles to the breeder, as seed can be produced on a large scale from cut branches, dwarf grafts, etc., in the greenhouse under controlled conditions. Brief mention is made of more special cases, e.g. interspecific and interracial crossings, breeding for rot- or cold-resistance, etc., and 'chromosomal' breeding (production of polyploids), and of the complementary work necessary in a breeding programme, e.g. determination of the latitudinal and altitudinal limits within which seed of a local race can be used, efficient propagation and cultivation, measures to induce early flowering.

[96]. 12.11.3 : 12.25 : 57 (489). BORNEBUSCH, C. H. Betydning af Rødgranfrøets Oprindelse. **[Importance of seed origin in Norway Spruce.]** *Dansk Skovforen. Tidsskr.* 26 (2), 1941 (69–71). [Dan.] [Statens forstlige Forsøgsvæsen, Denmark.]

Data (of spring, 1940; 22 years from planting, 26 years from sowing; recalculated per ha.) for sample plots of various Norway Spruce provenances grown at Valby Hegn, Denmark, are given in the accompanying table below.

The Danish Grib Skov provenance is relatively late in flushing and less susceptible to night frost in spring than other strains; it is therefore recommended for districts with comparatively severe climates, whereas for the milder regions the Thuringian provenance is preferable, though seed of good Danish or Central European provenances can also be used. The lower-yielding provenances are clearly undesirable.

[97]. 12.11.3 : 12.26–8 : 44.3. URQUIJO LANDALUZE, P. Hibridación de castaños. **[Hybridization of Chestnuts.]** *Agricultura, Madrid* 14 (159), 1945 (336–8). [Span.] A.P.B.

Experiments in hybridization have been carried out with the object of producing Chestnuts which combine the vigour and high timber quality of *Castanea sativa* with the resistance to ink disease (*Phytophthora cambivora*) displayed by the Japanese Chestnut (*C. crenata*). The difficulty in cross-pollination due to the earlier flowering of the Japanese Chestnut has been solved by suitable storage of its pollen. Hybrids resistant to infection by *Phytophthora cambivora* will be examined for further characteristics and reproduced vegetatively. The F_2 generation is expected to show more clearly the suitability or otherwise of the

Provenance	*After thinning, spring* 1940			*Total thinnings: stem volume* (*cu.m.*)	*Total yield* (*cu.m.*)	*Mean annual yield in* 22 *years* (*cu.m.*)
	Height (*m.*)	*Basal area* (*sq. m.*)	*Stem volume* (*cu.m.*)			
Steinkjer, Norway	7·2	22·0	86	23	109	5·0
Tavastehus, Finland	8·1	23·6	105	35	140	6·4
Smolensk, Russia	9·1	24·3	127	57	184	8·3
Wiesemhof, Latvia	9·6	23·9	128	62	190	8·6
Grib Skov, Denmark	9·8	25·6	143	71	214	9·7
Harz, Germany	9·3	25·7	136	49	185	8·4
Thuringia, Germany	9·8	27·6	154	66	220	10·0
Schwarzwald, Germany	10·3	27·9	163	98	261	11·9

hybrids for use in reafforestation. [Cf. *For. Abstr.* 8 (No. 685).]

[98]. 12.11.3 : 12.26–8 : 12.11.21 (489). LARSEN, C. S. Blomstring og Forædling hos Ask (*Fraxinus excelsior* L.). **[The flowering and breeding of Ash (*F. excelsior*).]** *Dansk Skovforen. Tidsskr.* 30 (3), 1945 (49–89). [Dan.]

A. Schulz [*Ber. dtsch. bot. Ges.* 10, 1892 (401–9)] concluded that Ash is in process of becoming dioecious, male trees being already numerous, females (probably of later origin) less so, and hermaphrodites relatively inconstant and connected with the extremes by many intermediates. A similar variability is confirmed by the author for Ash in Denmark: pure males are not very numerous, but trees predominantly male are more so; a few pure females are known and a number of trees that are predominantly female and may be regarded as such for ordinary purposes in the forest. Ash is normally decidedly protogynous (though selfing has proved possible under artificial conditions), and the stigmata appear to be receptive immediately after the bud scales have opened, whereas the anthers usually dehisce only when the inflorescence has developed. This is an important factor in breeding. Examples of various types of flower are figured and a case is quoted of an old tree in Jægerborg Dyrehave that had one portion of the crown female, with apparently more forked branching than the remaining male portion. Among the trees so far inspected in Denmark the males or predominantly males appear to have the best growth form; some good seedbearers (♀ or ⚥) have been found, but none as good in form as the best males. Sex also appears to be practically constant in the individual, to judge by present evidence, and in grafting experiments the scions seem to retain their own sex and their own times of flushing and leaf fall. Grafted scions of *F. obliqua* Tausch. and *F. oregona* Nutt. also retained their sex, and a preliminary examination of weeping forms of *F. excelsior* (propagated by grafting) suggests the same constancy, all examined having a mixture of ⚥ and ♀ flowers.

Apart from the use of dwarf grafted 'seedbearers' in greenhouses there are three main lines of work of possible value in Ash breeding: (i) *Establishment of seed plantations*: Grafting is likely to give considerably more reliable results than the use of seedling stock. It is provisionally estimated that with trees spaced 20 × 20 m., giving 25 per ha. of which 12 would be functionally ♀, the yield in a good seed year should be 420 kg. or about 4 million seeds per ha. Probably, however, a better final spacing would be 10 × 10 m., planting initially two rows each of ♂ and ♀ clones alternately, possibly deciding on the final seedbearers from the results of artificial crossings designed to show the best combination. The latter proposal would involve the use of pure ♀s, otherwise both pure and predominantly ♀ trees could be used. Ash is easy to graft and the use of grafted stock would enable single selected clones of either sex to be tried in combination with clones of the opposite sex. For ordinary practical purposes, simpler methods could be devised, including the grafting of selected material on older trees, which has the advantage of eliminating browsing damage and the risk of mistakes in dispatching or planting nursery stock. (ii) *Utilization of hybrid vigour* (*heterosis*): Known *Fraxinus* hybrids are few, and the author has had little success as yet with crossings of *F. excelsior* ♂ × *F. oregona* ♀ or of the latter with *F. pennsylvanica* ♂. Further investigation of inter- and intraspecific crosses, and of the possibilities of polyploidy, is desirable. (iii) *Vegetative propagation of single individuals* (*clones*) *for use direct in practice*: Ordinary grafting would be possible, though probably too expensive except for special purposes. Budding is also effective and is recommended as having the advantages of giving a better union, rapid formation of well developed plants when the bud grows up as the first annual shoot, rapid execution of the work and great economy in material. The question whether improvement in quality would balance costs must be left open. It should be possible to do the budding in the summer after transplanting 1/0 or 2/0 stock (to produce eventual plants with a 1-year graft shoot on a 1/2 or 2/2 rootstock), perhaps also after planting out or on wilding stock *in situ*. Budding will be a valuable method whenever genetically uniform stock is desired, e.g. in studies of the characters and reactions of clones. [Cf. *For. Abstr.* 8 (No. 91).]

Brief particulars are listed of élite trees so far reconnoitred in Denmark.

[99]. 12.11.3 : 12.26–8 : 21.61 : 21.32 : 11.47.21. BORNEBUSCH, C. H. Arv og Kaar.

[Heredity and environment.] *Dansk Skovforen. Tidsskr.* 26 (4), 1941 (167–72). [Dan.]

A note in extension of Møller's paper on the form of Ash [see *For. Abstr.* 5 (247)]. Bornebusch regards Oppermann's experiments as showing clearly the hereditary nature of form in Danish Oak and Beech, and quotes examples for Oak in support of this claim. Ash, on the other hand, seems to be a special case in which hereditary factors are more liable to be obscured by environmental influences, and probably the most that can be said is that, given corresponding environmental conditions, good progeny should be obtained from parent stands of good form. Without questioning the validity of Møller's hypothesis on the importance of phosphoric acid, Bornebusch suggests that good growth conditions in general, including adequate nitrogen in the soil, are necessary to Ash. If grown in competition with grass, this species is liable to develop a bushy crown, but covering the ground with slash or growing Alder in admixture (both of which treatments improve nitrogen supplies) will cause such trees to develop a strong leader. Bornebusch's analyses have shown that covering with slash also improves calcium, potassium and phosphoric-acid supplies.

[100]. 12.11.3. STEBBINS, G. L. **The cytological analysis of species hybrids. II.** *Bot Rev.* 11 (9), 1945 (463–86). [Univ. of California.]

Supplement to an article of the same title by Dr. Karl Sax in *Bot. Rev.* 1, 1935 (100–17).

Sections are devoted to the cytology of fertile species hybrids, species hybrids with slight irregularities of meiosis, hybrids with very irregular meiosis, polyploid species hybrids, possible causes of hybrid sterility and the nature of interspecific isolating mechanisms.

Genetic factors responsible for hybrid sterility may affect: (1) the mature F_1 hybrid at the critical stage of the formation of the reproductive organs and the archesporium, thus producing diplontic sterility, or sterility in the diplophase; and (2) the critical stage of meiosis itself, producing abnormal micro- or megaspores, or causing inviability of the gametophyte or gametes, and haplonic sterility. Group 2 includes a type with genic differences causing upsets of the spindle mechanism, timing relations and other physiological elements of the meiotic process; and a second predominantly chromosomal type. If parents have the same chromosome numbers and are closely related, the distribution of the chromosomes to the gametes is usually normal, and the haplonic sterility is most likely due to small structural differences in the chromosomes themselves, insufficient to prevent chromosome pairing, but giving inviable chromosome combinations, or inviable new chromosomes.

Species-isolating factors have evolved at different rates in different genera. In *Quercus*, *Salix*, *Vaccinium*, and other genera in which species with widely different external morphology and physiological adaptations form fertile hybrids, none of the isolating factors has become established.

Species divergence may come about either through hybridization between pre-existing species or through the segregation of large species populations into small geographically isolated groups, some of which would develop barriers of genetic isolation separating them from the rest.

[101]. 12.11.3:12.26–8. TAYLOR, H. **Cytotaxonomy and phylogeny of the Oleaceae.** *Brittonia* 5 (4), 1945 (337–67). [Blandy Experimental Farm, Boyce, Va.]

A list of chromosome numbers of 129 species and varieties of the Oleaceae has been compiled from the present investigation and the literature. Sixty-eight of these species and varieties are reported for the first time, and 32 others represent confirmations or corrections of previous counts. Drawings of representative types of chromosomes from each genus are presented.

Base numbers for the Oleoideae-Fraxineae are 13 (*Fontanesia*) and 23 (*Fraxinus*); for the Oleoideae-Syringeae 14 (*Forsythia*) and 23 (*Syringa*); for the Oleoideae-Oleineae 23 (*Phillyrea*, *Osmanthus*, *Forestiera*, *Chionanthus*, *Olea*, and *Ligustrum*); for the Jasminoideae-Jasmineae 11 (*Mendora*) and 13 (*Jasminum*).

As a result of convergent evolution, it is difficult to divide the family into natural groups on the basis of morphological characters alone, hence, the group has been rearranged on the basis of chromosome numbers, and the structure of the flowers and fruits studied in the light of the changes necessitated by such a system. The percentage of polyploidy occurring within genera and species is small, and it is evident that polyploidy has played only a minor role in speciation.

The stability of chromosome numbers throughout the Oleaceae make these valuable for taxonomic arrangements within the family. A phylogenetic chart presents graphically the relationship indicated for genera that have been studied cytologically. *From author's summary.*

[102]. 12.11.3 : 12.26–8. MENDES, A. J. T. Os cromosômios das Rubiáceas. **[The chromosomes of the Rubiaceae.]** *Bol. téc. Inst. agron. S. Paulo* No. 55, 1938. pp. 11 + plate. [Port.port.e.]

A list is given of the chromosome numbers of 165 species, varieties or hybrids of the Rubiaceae which have already been analysed cytologically. Almost 90 per cent. of the forms investigated belong to a polyploid series with the basic number 11.

[103]. 12.11.3 : 12.26–8. MENDES, A. J. T. Estudo citológico na quineira (*Cinchona* spp.). **[Cytological study on *Cinchona* spp.]** *Bol. téc. Inst. agron. S. Paulo* No. 58 [1939]. pp. 8, + plate. [Port.port.e.] *Separate* of *J. Agron.* 2 (1), 1939 (43–8).

The chromosome number was determined for two species of *Cinchona*: *C. ledgeriana* Moens ($2n = 34$) and *C. calisaya* Wedd. ($n = 17$). The basic number 17 is secondary, probably derived from $x = 9$, the basic number of other genera closely related to *Cinchona*. *Posoqueria* is the only other genus so far studied among the Rubiaceae in which the basic number is 17. [Cf. *For. Abstr.* 8 (Nos. 577–82).]

12.14. Organography. Morphology. Anatomy. Histology

[104]. 12.14 : 12.26–8 : 12.26–8. NAST, C. G., and BAILEY, I. W. **Morphology of *Euptelea* and comparison with *Trochodendron*.** *J. Arnold Arbor.* 27 (2), 1946 (186–92 + plates). [Biological Laboratories, Harvard Univ.]

The writers agree that *Euptelea* has been wrongly placed in the family Trochodendraceae, and on the basis of morphology should be placed in a separate unigeneric family, the Eupteleaceae. [Cf. *For. Abstr.* 8 (No. 159).]

[105]. 12.14.2 : 12.14.3 : 12.26–8. VIEIRA NATIVIDADE, J. Um tipo anómalo de periderme lenticular em raízes de *Quercus suber* L. **[An anomalous type of lenticular periderm in the roots of *Quercus suber* L.]** *Bol. Soc. broteriana* 19 (2 ser., pt. 1), 1944 (311–33 + plates). [Port.]

[106]. 12.14 : 12.25 : 12.11.23 : 12.14.2. GUNCKEL, J. E., and WETMORE, R. H. **Studies of development in long shoots and short shoots of *Ginkgo biloba* L. I. The origin and pattern of development of the cortex, pith and procambium.** *Amer. J. Bot.* 33 (4), 1946 (285–95). O.B.D.

[107]. 12.14.4 : 12.25 : 12.11.23 : 12.14.2. STERLING, C. **Growth and vascular development in the shoot apex of *Sequoia sempervirens* (Lamb.) Endl. III. Cytological aspects of vascularization.** *Amer. J. Bot.* 33 (1), 1946 (35–45). [Univ. of California, Berkeley, Calif.] O.B.D.

[108]. 12.14.4 : 12.26–8. OCCHIONI, P. O colateiro. Sôbre a estrutura primária do caule de *Cola acuminata* Schott et Endl. **[The Colateiro. On the primary structure of the stem of *Cola acuminata* Schott et Endl.]** *Rodriguésia* 8 (17), 1944 (73–4 + plates). [Port.]

[109]. 12.14.5. RODRIGUES, A. O polimorfismo foliar e os estudos de filometria. Aplicação practica de um método ampelométrico. **[Foliar polymorphism and studies in phyllometry. Practical application of an ampelometric method.]** *Agron. lusitana* 4 (4), 1942 (339–59 + plates). [Port port.e.]

Instances of foliar polymorphism are cited, and a description is given of the practical application of an ampelometric method developed by the author.

[110]. 12.14.5 : 01.7. BISTRUP, C. Bladarealer. **[Leaf areas.]** *Dansk Skovforen. Tidsskr.* 28 (1), 1943 (1–10). [Dan.]

The use of form factors (i.e., factors for reducing length × breadth, or either length or breadth squared, to the actual area) is suggested, on the basis of some preliminary trials, as an aid to the determination of total or mean leaf areas of a large number of leaves. For Beech the mean of 94 measurements of different types of leaf gave: area = 0·675 × length × breadth, but a simpler expression giving an error for the same material of less than 1 per cent. was: area = breadth^2. For Oak an initial division was made into form classes assessed by the ratio between breadth and length and for each form class a form factor was derived, expressing area as form factor × length^2; this factor varied with form class from 0·291 to 0·495, but it appears that for a large random sample of Oak leaves a mean form factor of 0·36 might be satisfactory. Form factors of the type calculated for Beech are listed for other common Danish species; these, though based on little material, all lie round 0·666, which is the value that would be obtained for an area bounded by two parabolic curves. Some results from tentative applications of this method to the determination of the leaf area of stands are included.

[111]. 12.14.7 : 12.26–8. SMITH, F. H., and SMITH, E. C. **Floral anatomy of the Santalaceae and some related forms.** *Ore. St. Monogr.* (*Stud. Bot.*) No. 5, 1942 (publ. 1943). pp. 93.

12.19. Geographical Distribution. Plant Geography and Sociology

[112]. 12.19. RIKLI, M. Das Pflanzenkleid der Mittelmeerländer. [**The vegetation of the Mediterranean countries.**] Verlag Hans Huber, Bern. [Vol. 2] Pts. 5–8, 1944–5. pp. 437–912. [G.]

See *For Abstr.* 6 (1–3). The second part of Chap. 8 has a discussion of the altitudinal forest and tree limits in the region and an account of the formations of the oreophytic belt, including coniferous and broadleaved-shrub as well as herbaceous formations. Succeeding chapters deal with: (9) the vegetation of individual mountain areas from Portugal and Morocco to the Caspian region; (10) the cultivable land, with sections on water as the chief factor in land use, types of cultivated land, the influence of man on vegetation, and economic, ornamental and adventive plants; (11) transitions on the one hand to steppe and desert steppe, with a brief discussion of the xeric limit of tree growth, and on the other to subtropical virgin forest, with a general account of the vegetation of Colchis and the Russo-Persian borderlands; (12) materials towards a plant geography of the region, with sections on the numerical representation of species, families and genera, and on immigration and pseudo-immigration (not yet completed in the published parts).

[113]. 12.19 (44) : 09. ENGEL, A. Mécanisme, et historique des migrations forestières de l'époque tertiaire à nos jours. [**The mechanism and chronology of forest migrations from the Tertiary period to the present day.**] *Bull. Soc. for. Franche-Comté* 24 (5; 6), 1944 (196–203; 223–8). [F.]

After a general discussion of climatic changes and migration and development of species, the author deals in rather more detail with the migrations of the genera *Fagus*, *Picea*, *Abies* and *Cedrus* in Europe and the Mediterranean region in prehistoric and historic times. He concludes that all existing species in Franche-Comté are ultimately of northern origin, and that their migrations are still continuing. The deterioration of climate was very clear from the end of the 16th to the end of the 18th century; it is shown in a lowering of the snow line and of the tree line, and in a corresponding lowering of the limit of cultivation of cereals and the vine in a great part of the Alps. It seems possible that we may be entering a new cold period, and an index of this may perhaps be given by the invasion of the forests of the plain by coniferous species such as Spruce and Fir, which is rapidly taking place in spots where those species were previously unknown in a natural state.

[114]. 12.19 (469). PINA MANIQUE E ALBUQUERQUE, J. DE. Zonagem fitoclimàtica como se tem feits em Portugal. [**Phytoclimatic 'zonage' in Portugal.**] *Agron. lusitana* 5 (3), 1943 (191–225 + plates). [Port.f.]

'Zonage' is a word created by Prof. A. Câmara (1939) to define the geographic 'polarization' of the agricultural sciences which tends to delimit the agricultural zones of a country in accordance with ecological, population, and economic conditions. The author gives a review of work on the phytoclimatic aspect of the natural regions of Portugal, beginning with the first vegetation map of the country made in 1878 by the Portuguese silviculturist and ecologist, Barros Gomes. Reference is also made to the work of Lautensach, H. Gaussen and W. Rothmaler.

[115]. 12.19 (469) : 12.25 : 09.2. TEIXEIRA, C. Subsídios para a história evolutiva do pinheiro dentro da flora portuguesa. [**Contributions to the evolutionary history of the Pine in the Portuguese flora.**] *Bol. Soc. broteriana* 19 (2 ser., pt. i), 1944 (209–21). [Port.] [Cf. *For. Abstr.* 8 (No. 31).]

[116]. 12.19 (47 : 48). HUSTICH, I. Några synpunkter på skogsgränserna i nordligaste Skandinavien. [**Some points of view on the limit of tree growth in the most northerly**

regions of Scandinavia.] *Svensk Skogv-Fören. Tidskr.* 42 (2), 1944 (132–41). [Sw.g.]

A review in lecture form. In Scandinavia proper the tree line is formed by *Betula tortuosa*, followed by scattered Scots Pine, Spruce coming in only somewhat lower. Farther east, in N. Russia, Spruce predominates at the tree line, and still farther east, Larch replaces Spruce. Larch, however, appears to require a calcareous soil for its occurrence so far north. Scots Pine has been shown to be very sensitive to climatic variations at its northern limit and its annual increment shows close correlation with the average July temperatures; to produce viable seed it requires an average summer temperature of 10·5° C., and with average summer temperatures exceeding 11·8° viability is good. It is argued that the present northern tree line is probably a biotic one in which woodcutting and fire have been important factors.

[117]. 12.19 (66.9) : 01.2. JONES, A. P. D. **Notes on terms for use in vegetation description in Southern Nigeria.** *Farm and Forest* 6 (3), 1945 (130–6, 164).

There is a long-felt want for some degree of standardization of terms for use in descriptions of vegetation in Nigeria. The writer briefly discusses and criticizes previous classifications, and then puts forward a provisional classification with the object of promoting discussion. He deals only with areas of high or medium rainfall and high humidity. His classification is as follows:—

- (A) Woodland
  - (1) High forest
    - (i) Hill forest
    - (ii) Swamp forest
    - (iii) Forest outliers
  - (2) Low forest
    - (i) Low primary seral vegetation
    - (ii) Farmland
    - (iii) Farm regrowth
    - (iv) Low secondary forest
    - (v) High secondary forest
    - (vi) Broken forest
- (B) Savanna
  - (1) Farm savanna
  - (2) Savanna woodland
  - (3) Transition farm savanna

The subdivisions are based, as far as possible, on easily recognized, physiognomic and physiographic features which can be used all the year round.

[118]. 12.19 (71.4). DANSEREAU, P. Les érablières de la Gaspésie et les fluctuations du climat. **[The Maple stands of the Gaspé peninsula and climatic fluctuations.]** *Contr. Inst. bot. Univ. Montréal* No. 51, 1944. pp. 18. [F.e.] *Extr.* from *Bull. Soc. Géogr. Québec et Montréal* (n.s.) 3 (1/2), 1944 (1–18).

The survival of some prairie groups, and some scattered *Quercus borealis*, *Pinus strobus*, and *Ulmus americana* in the Gaspé peninsula may be remnants of warmer times. The now cooling climate is indicated by disjunction of the Gaspè deciduous forest, by the elimination of certain species (e.g. *Fagus grandifolia*) and lessening vitality of others (*Sambucus pubens*, *Cornus alternifolia*). The pre-climax concepts of Clements seem to fit in here quite well, the Gaspé Maple association being pre-climax to the more generalized Canadian forest.

[119]. 12.19 (72). MIRANDA, F. Estudios sobre la vegetación de México. III. Notas generales sobre la vegetación del S.O. del Estado de Puebla, especialmente de la zona de Itzocan de Matamoros. **[Studies on the vegetation of Mexico. III. General notes on the vegetation of the south-east of the State of Puebla, particularly the Itzocan de Matamoros zone.]** *An. Inst. Biol. Univ. Méx.* 13 (2), 1942 (417–50). [Span.] I.I.E.

[120]. 12.19 (728.6) : 09.7. DAYTON, W. A. **Costa Rica—land of forests.** *Agric. in Americas* 5 (3), 1945 (43–6, 58). A.P.B.

The arborescent flora of Costa Rica is known to be exceptionally rich, but so far only the inhabited portion, or about one-quarter of the country, is comparatively well known botanically. The author briefly indicates the characteristic plant species of the five main vegetational types: (1) evergreen rain forest; (2) deciduous forest; (3) cloud forest; (4) Mangrove swamp; and (5) Palm swamp. [Cf. *For. Abstr.* 7 (No. 1622); 8 (No. 52).]

[121]. 12.19 (729.1). CARABIA, J. P. **The vegetation of Sierra de Nipe, Cuba.** *Ecol. Monogr.* 15 (4), 1945 (321–41 + map). [Atkins Institution of the Arnold Arboretum, at Soledad, Cuba.]

A general study of the vegetation of Sierra de Nipe in the north-eastern part of Cuba shows a high degree of endemism and a striking difference from the rest of the vegetation of Cuba, indicating that it is a relict area. Of the 8 communities, the most important are the *pinar* and the *charrascal*. In the *pinar*, *Pinus cubensis* is the dominant species and the herbaceous element is represented by a large number of grasses and sedges. The *charrascal* is a typically tropical community formed by a group of numerous woody shrubs and small trees which make an almost impenetrable thicket. In it the largest number of endemic species is found. An appendix contains a list of these endemic species. *From author's summary*. [Cf. *For. Abstr*. 7 (No. 1623).]

[122]. 12.19 (729.5) : 07.5. GREGORY, L. E., and VÉLEZ, I. **An ecological survey of the Polytechnic Institute Arboretum.** *Carib. For*. 7 (1), 1946 (1–36). [E.Span.e.span.f.]

The Polytechnic Institute Arboretum is a wood of 10·12 acres in western Puerto Rico, which in 1943 was set aside as an arboretum of native species. Before removal of exotic species, an intensive ecological survey was carried out in order to determine its structure, composition, and succession.

The forest had a total of 90 species of trees and shrubs and 80 species of other plants. *Myrcia splendens* made up about 16 per cent. of the trees. Of the trees, two species [*Mangifera indica* and *Hymenaea courbaril*] contributed about half of the total basal area. The forest has 3 layers, the tree, shrub, and ground layers. The tree layer is two-storeyed, with an almost continuous canopy and a continuous understorey. The most important species of the canopy are *Mangifera indica*, *Hymenaea courbaril*, and *Inga laurina*. Fifty per cent. of the stems and 25 per cent. of the species which make up the canopy are deciduous. The canopy trees are 55 to 65 ft. high and the largest are 26 to 32 in. in diameter. The most important species in the understorey are *Myrcia splendens*, *Eugenia jambos* [=*Jambosa jambos*], *Icacorea guadalupensis*, and *Amomis grisea*. Ninety-two per cent. of the stems and 87 per cent. of the understorey species are evergreen. The trees range from 15 to 40 ft. in height and from 4 to 11 in. in diameter. The shrub layer ranges from 5 to 8 ft. in height and is composed mostly of evergreen species. The ground layer consists mainly of seedlings, vines, and ferns. *From authors' summary*.

[123]. 12.19 (75.9) : 09.7 : 11.4. DAVIS, J. H. **The natural features of southern Florida, especially the vegetation, and the Everglades.** *Geol. Bull. Fla. Dep. Conserv*. No. 25, 1943. pp. 311 + maps.

Among the vegetation types described are: Pine forests; hammock forests (hardwoods and palms, usually dominated by broadleaved evergreens and limited to small areas) which are often a climax forest developed after a series or succession of other stages of vegetation; inland swamps, Cypress and Bay tree forests; Mangrove swamp forests.

[124]. 12.19 (78.8) : 12.19. JOHNSON, F. R. **Extending the range of Corkbark Fir.** *J. For*. 44 (1), 1946 (57). [U.S. Forest Service, Denver, Colo.]

[125]. 12.19 (81) : 09.7 : 91.7. CUNHA DA SILVA, J. A. Patrimônio florestal do Brasil. [**Brazil's forest heritage.**] *Brasil madeireiro* 1 (3), 1945 (20–1). [Port.]

The forests of Brazil may be divided into three ecologically distinct types: (1) the Amazonian forest; (2) the tropical forest; and (3) the forests of the Parana River Valley. The most important commercial species of each area are noted and a list is given showing the area under forest in each of the Brazilian states. According to the latest agricultural census about 58 per cent. (500,069,600 hectares) of the country is forested. A map of the main vegetational zones of Brazil is included. [Cf. *For. Abstr*. 7 (Nos. 1630–1).]

[126]. 12.19 (81) : 12.25. HESS, R. W. **Distribution of Parana Pine in Brazil.** *Trop. Woods* No. 85, 1946 (9–11).

A sketch map, showing the distribution of Parana Pine [*Araucaria angustifolia*] in Brazil, in correction of the map in Record and Hess *Timbers of the New World*.

[127]. 12.19 (87). BEARD, J. S. **Notes on the vegetation of the Paria Peninsula, Venezuela.** *Carib. For*. 7 (1), 1946 (37–56). [E.Span.f.] [Colonial Forest Service, Trinidad.]

These notes are the result of an expedition from 26th March to 14th April, 1944, in the north-eastern extremity of Venezuela. Shifting cultivation has destroyed much of the vegetation, and virgin forest is found only on inaccessible peaks. The soils are everywhere degraded and forest has been largely replaced by thorn bush. The composition of the cloud forest of northern Trinidad and of the Paria peninsula, which were continuous in comparatively recent geological times, is almost identical and the two can certainly be said to belong to the same association, which has been named in Trinidad the *Richeria-Eschweilera* association.

Comparison of the lower montane rain forest in the two countries is not possible, since only relicts of it remain in Paria, but many of the species found in Trinidad and Tobago are also found in Paria, including the following hitherto believed to be endemic in those two islands: *Micropholis cruegeriana*, *Sloanea purdiaei*, *Marila grandiflora*, *Euterpe broadwayae*, and *Bactris cuesa*. The elfin woodland which is found on the summits in Trinidad, does not occur in Paria, presumably because the mountains of Trinidad, lying to windward, break the main force of the trade wind. [Cf. *For. Abstr.* 7 (No. 1636).]

[128]. 12.19 (95):09.7. Lam, H. J. **Fragmenta Papuana: observations of a naturalist in Netherlands New Guinea.** Translated from the Dutch by Lily M. Perry. *Sargentia* No. 5, 1945. pp. [iv] + 196.

Appearing in *Natuurkundig Tijdschrift voor Nederlandsch-Indië*, 1927–29, under the common title 'Fragmenta Papuana' this series of articles (now translated fully with many of the original line drawings) embodies important botanical information on the Netherlands New Guinea. Three articles deal with the history of the expeditions, meteorology and ethnology, and the remaining four are studies of regional plant formations. Most of the records of species of plants are included in the narratives of the trail and the bivouacs, but certain ecological features are analysed or tabulated. Descriptions of rain-forest types are related to schematic representations which bring together the principal morphological and ecological characteristics of the plant associations, viz.: tropical lowland forest in the Lower Mamberamo, marsh and foothills forest of the Meervlakte, mountain forest of the Central Range. Other diagrams show the vegetation at various altitudes on slowly rising terrain from sea level to the forest limit at 3,000 m. and the tree limit at 3,580 m.; and between these extremes the percentage composition of the forest by number of individuals. The vegetation above the forest limit (Doormantop) is discussed more fully from the phytogeographical aspect. There is a good index.

12.19.1. *Regional Floras, including Check Lists*

[129]. 12.19.1 (51). Wen-Pei Fang [Editor]. *Icones plantarum Omeiensium* 2 (1), 1945. pp. [103] + 50 plates. [E.Chin.] [The National Szechuan Univ., Chengtu, Szechuan, China.]

Botanical descriptions of 50 species of Stachyuraceae, Hamamelidaceae, Meliaceae, Ericaceae, Fagaceae, Aceraceae, Juglandaceae, Ginkgoaceae, and Bignoniaceae, collected in the Mount Omei region of China, with the distribution in China, and large line drawings, 12 in. × 8 in., of each species.

[130]. 12.19.1 (71.21). Lowe, C. W. **List of the flowering plants, ferns, club mosses, mosses and liverworts of Manitoba.** Natural History Society of Manitoba. 1943. pp. 110 + map.

[131]. 12.19.1 (71.21). Fraser, W. P., and Russell, R. C. **A revised, annotated list of plants of Saskatchewan.** University of Saskatchewan, Saskatoon, Sask. 1944. pp. 61 + index.

[132]. 12.19.1 (73). Little, E. L., jr. **Check list of the native and naturalized trees of the United States, including Alaska.** U.S. Forest Service, Washington, D.C. 1944. pp. 325. P.R.

The new check-list supersedes Sudworth's check list of 1927.

[133]. 12.19.1 (74.1). Hyland, F., and Steinmetz, F. H. **The woody plants of Maine: their occurrence and distribution. An annotated catalog of the woody spermatophytes.** *Maine Bull.* 46 (11), 1944. pp. xix + 72 + map.

[134]. 12.19.1 (74.5). Howland, J. E. **Check list of trees and shrubs in Rhode Island.** *Mimeo. Circ. R.I. St. Coll.* No. 21, 1942. pp. 33 + [ii].

[135]. 12.19.1 (75.6). Curtis, M. A. **The shrubs and woody vines of North Carolina.** *Bull. N.C. Dep. Conserv.* No. 46, 1945. pp. viii + 38.

[136]. 12.19.1 (79.5:79.7). Munger, T. T. (Compiler). **A check list of the trees native to Oregon and Washington.** [Pacific Northwest Forest Experiment Station?] 1945. pp. 5.

[137]. 12.19.1 (88). Pulle, A. [Editor.] **Flora of Suriname (Netherlands Guyana). Vol. 2, part 2, 1940 (257–384). Papilionaceae (pars)—Mimosaceae—Connaraceae—Annonaceae—Droseraceae (pars).** *Meded.*

Kolon. Inst. Amst. No. 30 (*Afd. HandMus* No. 11).

[138]. 12.19.1 (88). PULLE, A. [Editor]. **Flora of Suriname (Netherlands Guyana). Vol. 3, part 2, 1942 (1–48). Erythroxylaceae — Oenotheraceae — Rhizophoraceae — Oxalidaceae (pars).** *Meded. Kolon. Inst. Amst.* No. 30 (*Afd. HandMus.* No. 11).

[139]. 12.19.1 (88). PULLE, A. [Editor]. **Flora of Suriname (Netherlands Guyana). Vol. 4, part 2, 1940 (257–352). Verbenaceae —Avicenniaceae—Asclepiadaceae (pars).** *Meded. Kolon. Inst. Amst.* No. 30 (*Afd. HandMus.* No. 11).

12.19.2. *Forest Types*

[140]. 12.19.2 (485). ARNBORG, T. Det nordsvenska skogstypsschemat. **[Schedule of the forest types of Northern Sweden.]** Svenska Skogsvårdsföreningens Förlag, Stockholm. 1945. pp. 18 + plates. [Sw.]

A simple, concise account of Eneroth's system of forest types for Northern Sweden, with descriptions and in most cases photographs of the ground vegetation characteristic of each. The distinctions given are based on the ground vegetation of relatively old stands of good density and it is emphasized that the changes occurring under other conditions must be observed and learnt. In the main, the types express combinations of 4 classes of soil-nutrient availability with 5 classes of soil moisture: they are of direct utility in judging the possibilities of regeneration (that of Pine, Spruce, and Birch is briefly discussed by types) and the need for auxiliary measures to this end on a given site, and are useful also as a rough guide to site quality [cf. *For. Abstr.* 8 (No. 770)], though considered less reliable in the latter respect than Cajander's types in Finland.

[141]. 12.19.2 (6). AARTSEN, J. P. VAN. **Woodland types and their distribution in Africa.** *Repr.* from *Int. Rev. Agric.* 34 (11/12), 1943 (413T–21T).

A condensed survey of African forest types and their distribution, based mainly on the classification scheme of Burtt Davy. The author distinguishes 23 types. A short section is added on plantations in Africa. The contents of this article are mainly drawn from the *International Yearbook of Forestry Statistics, Vol. III, Africa* [see *For. Abstr.* 8 (No. 37)].

12.19.4. *Succession*

[142]. 12.19.4 (44). GEORGES, P. Essai de classification géographique des associations végétales forestières de l'ouest entre bocage normand et Touraine. **[Attempt at a geographical classification of the forest vegetation associations of the west, between the Norman bocage and Touraine.]** *Rev. Eaux For.* 83 (12), 1945 (687–703); 84 (1), 1946 (11–26 + plates). [F.]

The region covered in this study is the basin of the three rivers (Mayenne, Sarthe, and Loire) which combine to form the Maine. It is the most heavily wooded area of Western France with a wide variety of forest types ranging from high forest of Oak or Beech to gorse-grown landes, the principal intermediate types being dry Oak forest of the 'gâtine' type and artificial, but generally well acclimatized, woods of *Pinus sylvestris* and *P. pinaster*. The writer holds that neither a purely geographical nor a purely phytosociological classification will serve to describe such a region, principally because they ignore the influence of man on the evolution and physiognomy of vegetation. Using the conception of the *regional paraclimax* he attempts a classification, using such data as indices of aridity, temperature, etc. He defines the paraclimax as a stable vegetational unit, occupying uncultivated land and presenting an appearance of stability in existing conditions of soil and climate. This conception is particularly useful where, as in the area here investigated, the natural vegetation no longer exists.

12.2 *Special [Systematic] Botany*

12.21. Fungi

[143]. 12.21 (489) : 44.3. NEERGAARD, P. **Danish species of *Alternaria* and *Stemphylium*: taxonomy, parasitism, economical significance.** Einar Munksgaard, Publisher, Copenhagen. Humphrey Milford, Oxford University Press, London. 1945. pp. 560.

A comprehensive treatment of the subject, including pathogenetic investigations, nomenclature, morphology, taxonomy and pathology. Amongst the species included are *Alternaria tenuis* which causes discoloration of wood pulp.

[144]. 12.21 : 44.3. SHEAR, C. L. **Studies of types and authentic specimens of Hypoxylon—I.** *Lloydia* 8 (4), 1945 (245–62).

[U.S. Plant Industry Station, Beltsville, Md.] E.M.B.

12.25. Gymnosperms

[145]. 12.25 (72). Martínez, M. Tres especies nuevas mexicanas del genero *Abies*. **[Three new Mexican species of the genus *Abies*.]** *An. Inst. Biol. Univ. Mex.* 13 (3), 1942 (621–34). [Span.] I.I.E.

Abies durangensis, *A. mexicana*, and *A. vejari* spp. nov.

[146]. 12.25 (72). Martínez, M. Nuevas especies de *Juniperus* mexicanas. **[New Mexican species of *Juniperus*.]** *An. Inst. Biol. Univ. Méx.* 15 (1), 1944 (7–15). [Span.] I.I.E.

Juniperus gamboana and *J. comitana*, spp. nov.

[147]. 12.25 (79.4). Metcalf, W. **Another pyramidal specimen of *Juniperus occidentalis*.** *J. For.* 44 (1), 1946 (57–8). [Univ. of California.]

[148]. 12.25:01.6. LeBarron, R. K. [Compiler]. **Annotated bibliography of Black Spruce [*Picea mariana*].** Lake States Forest Experiment Station, University Farm, St. Paul, Minnesota. [1944?]. pp. 9.

[149]. 12.25 (72). Martínez, M. Una nueva especie del genero *Pinus*: *Pinus michoacana*. **[A new species of *Pinus*: *P. michoacana*.]** *An. Inst. Biol. Univ. Méx.* 15 (1), 1944 (1–6). [Span.] I.I.E.

[150]. 12.25 (85):33.12. Vargas, C. C. Plantas económicas del Peru. **[Economic plants of Peru.]** *Agronomia, Lima* 8 (34), 1943 (33–6). [Span.] [Univ. de Cuzco.] L.S.

Podocarpus glomeratus Don., *P. oleifolius* Don. and *P. utilior* Pilger, endemic in Peru, yield timber for cabinet-making. Characteristics and uses are summarized.

12.26-8. Dicotyledons

[151]. 12.26–8 (72). Miranda, F. Nuevas fanerogamas del S.O. del Estado de Puebla. **[New phanerogams from the south-east of the State of Puebla.]** *An. Inst. Biol. Univ. Méx.* 13 (2), 1942 (451–62). [Span.] I.I.E.

Bursera vejar-vazquezii, *Cedrela poblensis*, *Fouquieria ochoterenae*, and *Jatropha riojae* spp. nov.

[152]. 12.26–8 (81). Ducke, A. **New forest trees and climbers of the Brazilian Amazon. Fifth Series** (1). *Bol. téc. Inst. agron. Norte* No. 4, 1945. pp. 29 + plates. [E.]

New species of *Brosimum*, *Belicostylis*, *Aptandropsis* (gen. nov. Olacaceae), *Compsoneura*, *Iryanthera*, *Virola*, *Sacoglottis*, *Vochysia*, *Dendrobangia*, *Sterculia*, *Matisia*, *Renggeria*, *Buchenavia*, *Chimarrhis*, *Stiriolaria* (gen. nov. Rubiaceae).

[153]. 12.26–8. Monachino, J. **A revision of *Macoubea* and the American species of *Landolphia* (Apocynaceae).** *Lloydia* 8 (4), 1945 (291–317). [N.Y. Botanical Garden, Bronx Park, New York.] E.M.B.

[154]. 12.26–8. Rivera M., I. Estudio botanico e historico acerco del 'palo copado', *Quararibea funebris* (Llave) Standl. **[Botanical and historical study of Palo Copado (*Quararibea funebris* (Llave) Standl.]** *An. Inst. Biol. Univ. Méx.* 13 (2), 1942 (499–502). [Span.] I.I.E.

[155]. 12.26–8:21.61. Croizat, L. **Winter identification of *Euonymus*.** *Amer. Nurserym.* 83 (1), 1946 (7–10).

A discussion of the characters by which to identify in winter the 18 deciduous species of *Euonymus* grown in gardens in the United States. *E. europaeus* should not be grown, as it is peculiarly liable to infestation by a scale which then spreads to other trees and shrubs.

[156]. 12.26–8 (81). Ducke, A. **New or noteworthy Leguminosae of the Brazilian Amazon.** *Bol. téc. Inst. agron. Norte* No. 2, 1944. pp. 33. [E.]

[157]. 12.26–8 (81). Ducke, A. O gênero *Strychnos* L. na Amazônia Brasileira, com a descrição de uma espécie nova: *Strychnos pachycarpa* n. sp. **[The genus *Strychnos* in Brazilian Amazonia, with a description of a new species: *Strychnos pachycarpa* sp. nov.]** *Bol. téc. Inst. agron. Norte* No. 3, 1945. pp. 23 + plate. [Port.]

[158]. 12.26–8 (95). Merrill, E. D., and Perry, L. M. **Plantae Papuanae Archboldianae, XVII.** *J. Arnold Arbor.* 27 (2), 1946 (193–233).

Descriptions of numerous new tree species in the remaining genera of the Psychotrieae not considered in previous papers, viz.: *Psychotria*, *Cephaelis*, *Saprosma*, *Amaracarpus*.

[159]. 12.26–8. SMITH, A. C. **A taxonomic review of *Euptelea*.** *J. Arnold Arbor.* 27 (2), 1946 (175–85).

Euptelea is so isolated that it must be placed in a unigeneric family. The genus is reduced to only two species, one Japanese and the other Chinese-Indian in distribution. [Cf. *For. Abstr.* 8 (No. 104).]

13. FOREST ZOOLOGY

13.1. *General Zoology*

See also *For. Abstr.* 8 (No. 188).

[160]. 13.15 : 13.2 (79.3 : 79.4) : 12.19 : 12.25. MILLER, A. H. **Vertebrate inhabitants of the Pinon association in the Death Valley region.** *Ecology* 27 (1), 1946 (54–60).

In the Grapevine Mountains on the borders of California and Nevada the Piñon (*Pinus monophylla*) belt extends from 6,000 to 8,700 ft. and develops locally a high-forest climax stand, which has made possible the establishment of various species of birds not normally associated with it.

[161]. 13.15 : 13.2. MACKENZIE, J. M. D. **The preference shown by birds for different species of trees in plantations.** *Forestry* 19, 1945 (97–112).

As a result of counts made in about 120 plots, it was found that birds of the thicket type have strong preferences for nesting in certain tree species. Sitka Spruce is the most popular species found, and Norway Spruce next, then *Cupressus macrocarpa*, Douglas Fir, *C. lawsoniana*, *Thuja plicata*, *Abies grandis* and Hemlock. Scots and Corsican Pine, Mountain Pine, Larch, Yew, and those broadleaved species examined (Willow, Alder, Oak, Birch, Beech, Poplar) all give poor nesting sites. The suggestion is made that small plots of Sitka and Norway Spruces planted in suitable places in plantations of other species giving bad nest sites, will increase the number of birds, and examples are given of plots of this nature found to contain 40 to 50 nests per acre per annum. [Cf. *For. Abstr.* 7 (No. 1687).] *From author's summary.*

[162]. 13.15 : 13.2 (47.1). SIIVONEN, L. Zum Auftreten der Ameisen (Hym., Formicidae) auf verschiedenen Waldböden. **[The occurrence of ants (Hym., Formicidae) on various woodland soils.]** *Ann. ent. fenn.* 6 (3), 1940 (50–62). [G.] I.I.E.

Records of the total population, and degree of dominance of *Myrmica rubra* L., *Lasius niger* L., *Formica rufa* L., *Leptothorax acervorum* Fbr., *Formica fusca* L., and *Camponotus herculeanus* L., during summer on 6 sample plots.

2. SILVICULTURE

[163]. 2 (489) : 65 : 35 : 95.1. ABELL, J. Træartsforskydning. **[The displacement of tree species.]** *Dansk Skovforen. Tidsskr.* 30 (7), 1945 (213–59). [Dan.]

A review of representative but partial figures for age-class distribution of the main species in the larger private forests and the State forests of Denmark, which give witness to the spread of exotics, chiefly Norway Spruce, at the expense of native hardwoods, especially Beech, and especially during the last few decades. Three major zones are recognized in this connexion: (i) a poor zone in the west and north, with a severe windy climate, where the economic choice of species is limited by biological considerations (Beech site qualities 3·3 and lower); (ii) a medium zone where Beech was formerly the dominant (Beech site qualities 2·3–3·2), where choice of species from the silvicultural point of view is comparatively free and thus very liable to be influenced by current markets for timber, and where Beech is being steadily replaced, mainly by Norway Spruce; (iii) a rich zone in the coast areas of the south and east (Beech site qualities 0–2·2) where choice of species is again affected by special growth conditions particularly favourable to hardwoods. The main reason for conversion to conifers has been a marked shortage of coniferous timber coupled with the poor financial returns for Beech. Though a decrease in the area under Beech was inevitable, because otherwise the forest area of the country would have been too small to accommodate all the species required, a one-sided development towards conifers should be checked for the sake of both biological needs and those of the home timber market, which is a major factor and which will probably be best served, in view of the uncertainty of future conditions, by a balanced supply of different timber species. So far there seems to be no serious loss of balance in the areas under different species, but continuation of present trends might have undesirable consequences. There are some indications that a glut of certain dimensions of coniferous timber may occur in about 1970. Maintenance of sufficient Beech is the greatest problem, but it is possible that the situation might be eased by new means of utilization, greater recognition of the silvicultural value of this species, methods of reducing plantation costs, and public aid in the form of tax relief or subsidies [cf. *For. Abstr.* 8 (No. 778)]. The last possibility is held to be highly desirable. Emphasis is laid on the notion of a 'division of labour' between species by regions and sites, and on alternating or mixed crops as a means of achieving a biological and economic balance [cf. *For. Abstr.* 8 (Nos. 621–2)]. As a rough guide, it is estimated that in zone (ii), about two-thirds of the forest area should be under hardwoods and one-third under conifers, whereas in the remaining zones the tendencies should be towards 100 per cent. under conifers in (i), and 100 per cent. under hardwoods in (iii).

[164]. 2(68.9):09.7. KELLY-EDWARDS, E. J. **Forestry notes for conservation officers. II. Uses of indigenous forest: wind breaks: general tree planting.** *Bull. Minist. Agric. S. Rhod.* No. 1320, 1945. pp. 12. *Repr.* from *Rhod. agric. J.* 42 (5), 1945 (434–44).

For Pt. I see *For. Abstr.* 8 (No. 68).

Southern Rhodesia uses about 3½ million cords of timber annually, mostly obtained from indigenous forests. The author deals briefly with methods (particularly thinning) for improving the yield of indigenous forest, pasture improvement, reduction of timber loss through wasteful methods of felling and utilization, the value of windbreaks in increasing agricultural production and providing timber for use on the farm, and the importance of care in planting out young trees. Many farmers are reluctant to grow windbreaks because of decreased crop yields in the 'sapping zone' immediately adjacent to the trees, but figures from the United States indicate that the beneficial effects on the rest of the crop more than outweigh any loss of yield in the 'sapping zone'.

[165]. 2(89):21.0. SANCHEZ ROGE, H. Los arboles forestales. **[Forest trees.]** Ministerio de Ganaderia y Agricultura, Uruguay. 1943. pp. 256. [Span.]

A comprehensive practical handbook, copiously illustrated, giving information on nursery practice, planting out, insect pests and diseases of forest trees, plantations for special purposes (e.g. timber production, soil improvement, shade, shelter, parks, roads, dune fixation, soil conservation), species (native and exotic) suitable for planting in Uruguay (with notes on their botanical classification, silvicultural characters and wood properties), wood seasoning and preservation, the manufacture of charcoal, the utilization of producer gas from wood, and forest legislation in Uruguay.

[166]. 2:12.26–8:4:3:56(54). MAHENDRU, I. D. **The Kikar or Babul (*Acacia arabica*, Willd.).** *Punjab For. Rec.* 2 (2), 1944 (publ. 1946). pp. [v] + 16 + plate.

Acacia arabica, although not indigenous in the Punjab, occurs self-sown or cultivated throughout the arid tracts wherever the winter is not too severe. The Kikar-bearing areas of the Punjab are classed as: (1) riverain, (2) ravine (or inland); (3) canal and roadside avenues. Notes are given on the general climatic and soil requirements of the species; the phenology of leafing, flowering and fruiting; seed extraction, seed weight, seed storage, and pre-treatment of seed; natural and artificial regeneration; the agri-silvicultural method of stocking with Kikar; weedings, cleanings and thinnings; injuries; management; rotation; general characteristics of the timber; seasoning; minor products obtainable from the Kikar; and growth statistics from the Punjab. [Cf. *For. Abstr.* 8 No. 568).]

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

[167]. 21:12.25 (410). ROBINSON, SIR R. L. **A note on Corsican Pine.** *Forestry* 19, 1945 (1–3).

Corsican Pine (*Pinus laricio* var. *corsicana*) grows well on the sandy heaths of southern and eastern England and on sand dunes as far north as Culbin on the Moray Firth. It is the best tree on recently fixed dunes, but may be a failure on tightly packed, damp flats between the dunes. It does well on loams and even heavy clays (e.g. Isle of Wight). It does not live long on limestone and chalk soils and there are definite limits to the elevations to which it can safely be taken in hilly country. In the industrial midlands it is the best conifer for smoky sites. When grown on economical rotations the timber is practically all sapwood and very absorbent of creosote. It is one of the best softwoods for plywood. Comparative rates of growth of Corsican and Scots Pine in East Anglia are tabulated. The mean annual increment per acre for the first 25 years is: Corsican Pine 125 cu. ft., Scots Pine 78 cu. ft. [See also *For. Abstr.* 8 (No. 652).]

[168]. 21 : 12.25 (74.1) : 12.19 : 23.1 : 4. CURTIS, J. D. **Preliminary observations on Northern White Cedar in Maine.** *Ecology* 27 (1), 1946 (23–36). [Department of Forestry, Univ. of Maine.]

In this 5-year study of Northern White Cedar (*Thuja occidentalis*) in Maine, which emphasizes the silvical habits of the species, the following points appear to be of significance. Northern White Cedar is found throughout Maine, but most abundantly in the northern part. It occurs in both mixed and pure stands. Trees of the poorest form and growth occur in the swamps and those of the best form and growth in pastures and abandoned fields. It was found in soils ranging from a pH of 4·50 on the uplands to a pH of 7·25 in the swamps. Swamp trees commonly reproduce vegetatively and trees on upland soils by seed. While 1-, 2-, and 3-year seedlings may exceed 1½ millions per acre in the swamp type, few of them reach maturity, chiefly owing to fluctuations in the water table and smothering by sphagnum moss. There is some evidence that this species is not so tolerant as was formerly believed, and this is borne out by the scarcity of advance reproduction, especially seedlings, over 1 ft. in height, in all stands containing Cedar. Snow, ice, deer and porcupines are probably the most serious destructive agencies. The species is relatively free from serious insect injury. An unknown parasitic disease is responsible for deaths of trees up to 8 in. d.b.h. and 25 ft. in height on all sites where Cedar is found. *From author's summary.*

[169]. 21 : 12.26–8 : 12.11.3 (73). DILLER, J. D. **Further research needed. Comments on Professor J. Russell Smith's article 'The Chinese Chestnut as a timber tree: open letter to foresters'.** *For. Leaves* 35 (4/5), 1945 (15).

In commenting on a previous article on Chinese Chestnut (*Castanea mollissima*) [see *For. Abstr.* 7 (No. 1142)] the writer gives later data on an orchard of Japanese Chestnut (*Castanea crenata*); of the original 2,000 two-year-old seedlings planted in 1897, only one-fourth are still alive, and of these only 133 (6·7 per cent.) still make a small annual increment. These best trees average slightly over 13 in. d.b.h. and are about 30 ft. high. The division of Forest Pathology has under test certain strains of Chinese Chestnut, the most promising of which is a strain brought from Nanking in 1924; in deep, well drained, moist soils, some of the trees have attained dimensions of over 6 in. d.b.h. and 50 ft. in height in less than 20 years. [Cf. *For. Abstr.* 8 (Nos. 97, 685).]

21.0. *Adaptability to the General Environment. Acclimatization*

[170]. 21.0 (44) : 23.23.12. POURTET, J. L'organisation de l'étude des essences exotiques en France. **[The organization of the study of exotics in France.]** *Bull. Soc. for. Franche-Comté* 24 (6), 1944 (228–35). [F.] [Station de Recherches et Expériences forestières, Nancy.]

A short historical account of the introduction of exotic tree species is followed by an exposition of the programme of investigation planned by the Station de Recherches et Expériences forestières. Notes are given on the arboreta of Les Barres, Amance, Royat. One of the most urgent problems is the collection of seed, and starting in 1942 the Station de Recherches began to collect seed of existing plantings of *Abies grandis*, *A. nordmanniana*, *Chamaecyparis lawsoniana*, *Thuja gigantea* and *Tsuga heterophylla.*

[171]. 21.0 (44) : 12.25 : 07.5. POURTET, J., and DUCHAUFOUR, P. Catalogue des espèces cultivées dans l'arboretum des Barres. **[Catalogue of the cultivated species in the arboretum of Les Barres.]** *Ann. Éc. Eaux For. Nancy.* 9 (1), 1944 (1–230 + plates + maps). [F.]

This first part of the new catalogue of the national Arboretum at Les Barres gives a general account of the arboretum, its history, climate, soil, etc. and then a detailed catalogue of the coniferous species, including natural habitat, distribution and habit, dimensions of the larger specimens in the arboretum, and indications of the possibilities of acclimatization in an environment similar to that of Les Barres (in S.W. France). Particular attention is given to provenance and races.

[172]. 21.0 (44) : 12.25. Pourtet, J., and Duchaufour, P. Possibilités d'utilisation en France de quelques essences canadiennes. **[Possibilities of using some Canadian species in France.]** *Rev. Eaux For.* 84 (3), 1946 (128–52). [F.]

For each species dealt with, notes are given on distribution and ecology in its natural habitat, economic interest, results so far obtained in growing it in France, possibilities of use and silviculture. The following species are included: *Pinus resinosa, P. banksiana, P. contorta* var. *murrayana, P. strobus, P. ponderosa, Abies grandis, Pseudotsuga douglasii, Tsuga heterophylla, Picea sitchensis, Thuja plicata.*

[173]. 21.0 (469) : 09.7 : 07.5. Gaussen, H. La question forestière et l'oeuvre des forestiers au Portugal. **[Forestry and the work of foresters in Portugal.]** *Rev. Eaux For.* 82 (1; 2), 1944 (1–20; 73–82 + plates). [F.]

After a general account of land utilization in Portugal, the reforestation law of 1938 is discussed and notes are given on the principal exotics in use, the most important of which are *Quercus rubra, Castanea crenata, Pseudotsuga taxifolia, Chamaecyparis lawsoniana, Larix* spp., *Acacia* spp. *Pinus maritima* has been much used for dune fixation and various Eucalypts (notably *E. globulus* and *E. rostrata*) for swamp reclamation. The second part of the article gives some account of forestry research in Portugal, including the projected silvetum at Cintra, where the Maritime Pines are to be replaced by exotic species grouped as in natural forests.

[174]. 21.0 (489) : 12.25 : 12.11.3. Holten, J. Lærk i Nordøstsjælland. II. **[Larch in north-east Sjælland. II.]** *Dansk Skovforen. Tidsskr.* 29 (5), 1944 (169–207). [Dan.]
21.0 (489) : 12.25 : 12.11.3. Holten, J. En Forelæsning om Lærk. **[A lecture on Larch.]** *Dansk Skovforen. Tidsskr.* 29 (12), 1944 (497–510). [Dan.]

The history and silvicultural characters of Danish-grown Larch species are reviewed. European Larch is best on the medium site qualities, on the higher ground in undulating country; pure stands and mixtures with Norway Spruce or Silver Fir are undesirable, and mixtures with Beech or other hardwoods are to be preferred. Japanese Larch, on the other hand, will grow on a wide range of the poorer soils from sands to moist stiff clays or even peat, and can be raised in pure stands, especially as an advance crop in afforestation, owing to its ability to stifle grasses, heather, etc.; it is less susceptible to *Dasyscypha*, more so to *Fomes annosus*, but more tolerant of moist, more or less stagnant air than is European Larch. So far as experience goes, the Japanese × European hybrids (both the original Scottish cross and the reciprocal hybrid, which has occurred in Denmark) seem to combine the better qualities of their parents and are regarded as promising. Korean Larch, on account of its slower growth and the present inadequate knowledge of its characters, is recommended for experimental planting only, while Siberian Larch shows slow growth and high susceptibility to canker, and appears to be outside its climatic range in Denmark. The chief points in Larch silviculture are (i) seed source; (ii) proper consideration of locality factors; (iii) *individual* tending, including dry pruning of valuable stems to a height of about 10 m. Seed of Danish-grown European Larch was used locally early in the 19th century, but as other supplies became available interest declined and Larch lost popularity through the introduction of poor Alpine strains, fears about the extent of canker damage, and the introduction of the Japanese species. In N. Sjælland, however, plantings were continued, so that stands of all age classes exist there and may be valuable for seed collection. Practically all is believed to be originally of Alpine provenance; some genuine Sudeten Larch has been raised very recently, but there is no record of the Carpathian or S. Polish races in Denmark. Holten discusses the probability that the Alpine seed used was genetically heterogeneous and thus offered good prospects for selection (climatic or by competition, thinning practice or fungus attack). He believes that fine-branched types are less liable to canker (owing to better natural pruning and occlusion of knots) and that self-sown is finer branched than planted stock, probably as a result of selection, which is thought to have given rise already to a 'Danish race' of European Larch. In future, seed supplies should be sought in order of preference, from Danish stands, Swedish ones of Scottish provenance or direct from Scotland, and possibly from Sudeten and S. Polish sources. It is desirable that seed should be taken from stands (*a*) that have passed the age (15–30) at which canker attack is most prevalent, (*b*) that represent several generations of growth in Denmark or in a similar climate. Some preliminary breeding work has been undertaken by the author, including the establishment of a seed stand, thinned to eliminate poor and cankerous stems, from seed of the best individuals in a self-sown group of European Larch derived from a good 55-year-old stand raised from Danish seed; a similar project with Japanese Larch has been started, and some graftings, chiefly of Japanese in European Larch stands, have been made with a view to seed production. [Cf. *For. Abstr.* 7 (No. 1773); 8 (Nos. 216, 747).]

[175]. 21.0 (489) : 12.26–8. LYEBYE, S. Rødeg. **[Red Oak.]** *Dansk Skovforen. Tidsskr.* 27 (7), 1942 (293–325). [Dan.dan.]

A review. Compared with Pedunculate Oak, Red Oak (*Quercus borealis* Michx.) in Denmark is believed to combine the advantages of lower demands on the soil, quicker height growth and greater volume yield, higher heartwood percentage, resistance to mildew and to most insects, good qualities as a soil improver, and aesthetic value. Frost resistance has been insufficiently investigated as yet but is probably high in some provenances of this species. The chief, and possibly only, disadvantage is the somewhat lower quality of the wood compared with that of the native Oak. So far as present knowledge goes, the appropriate silvicultural treatment is the same in the main as that for native Oak. The desirability is urged of a systematic investigation of all existing Red Oak stands in Denmark. [Cf. *For. Abstr.* 7 (No. 1700).]

[176]. 21.0 (77.7) : 12.25. MCCOMB, A. L. **Virginia Pine in Iowa.** *J. For.* 44 (1), 1946 (60–1). [Iowa State College.]

The author gives an account of trial plantations of Virginia Pine [*Pinus virginiana*] and concludes that the development of these and of naturally introduced groups indicates that this species may be of considerable value for reclamation of gullies and spoil mounds. It and Red Cedar (*Juniperus virginiana*) are the only conifers known to be capable of reproducing themselves naturally in south-eastern Iowa. Present plantings indicate that Virginia Pine is adapted for survival in Iowa at least as far north as 41·5° north latitude, and as far west as the 94th meridian.

[177]. 21.0 (81) : 12.26–8. O Eucaliptus. **[The Eucalypts.]** *Brasil madeireiro* 1 (6), 1945 (29–32). [Port.]

A general account of Eucalypts and an annotated list of 23 species acclimatized or capable of becoming acclimatized in the State of São Paulo, Brazil.

[178]. 21.0 (81) : 12.26–8 : 31.41. GONÇALVES CARNEIRO, J. *Eucalyptus* versus Guarantã. **[*Eucalyptus* versus *Esenbeckia leiocarpa.*]** *Brasil madeireiro* 1 (7), 1945 (39–40). [Port.] *Repr.* from *Estado de São Paulo.*

The author disagrees with the discouragement of planting of *Eucalyptus* spp. in Brazil merely because the Eucalypts are exotics. *Eucalyptus* timber is more durable than that of most native species, including Guarantã (*Esenbeckia leiocarpa* Engl.), and it should continue to be planted commercially in Brazil.

[179]. 21.0 (82) : 60.31.2. LUCIONI, P. La plantación de esencias maderables para las necesidades de la chacra. **[The planting of timber species for farm requirements.]** *Alm. Minist. Agric. Argentina* 19, 1944 (301–3). [Span.] A.P.B.

Among the species recommended for planting on Argentine farms to provide timber for farm use are *Eucalyptus rostrata*, *E. tereticornis*, Willow, Algarrobo and Quebracho Blanco.

[180]. 21.0 (86) : 12.26–8 : 60.31.3. MARRERO, J. El cultivo del eucalipto en la Sierra de Ecuador. **[The planting of *Eucalyptus* in the Ecuador Sierra.]** *Carib. For.* 7 (1), 1946 (57–69). [Span.E.f.] [Tropical Forest Exp. Sta., Puerto Rico.]

The timber shortage in Ecuador has been partially solved by the introduction of *Eucalyptus globulus*. In Ecuador it grows at altitudes between 1,600 and 3,500 m., and optimum growth is attained between 2,000 and 2,700 m. In this zone the prevailing temperature is 10° to 20° C., but precipitation varies considerably; Quito receives an average of 43·08 in. of rainfall annually, while Ambato is drier. *Eucalyptus* is grown mainly on deep volcanic soils, classified as lithosols, but also does well in degraded soils. The writer measured a felled tree 1·7 m. in diameter and the gigantic Eucalyptus of Ambato, considered to be the oldest in Ecuador, is said to be 2·5 m. in diameter. Seedlings 15–20 cm. high are generally used for field planting, in holes 45 cm. square and of the same depth. Near Quito, block plantings are common, but in other parts of the Sierra fence-row plantings predominate. A 2-m. spacing is recommended for fuelwood rotations and 2·5-m. spacing for longer rotations. The first thinning is generally done during the fifth year, removing about 50 per cent. of the trees. Studies by the Forest Service of the Compañía Paulista indicate, however, that thinnings are not necessary at 2-m. spacing with a 7-year fuelwood rotation. When 2·5-m. spacing is used with longer rotations, the practice of this company is to make the first thinning after 10 years, leaving 60 per cent. of the trees. The 2nd and 3rd thinnings usually take place in the 15th and 20th years after planting. Trees of less than 10 cm. in diameter are cut in the first thinning, all trees between 10 and 15 cm. in the second thinning, and all trees of less than 20 cm. in the last. The plantations are mainly destined for fuelwood and clear cutting is the usual method of exploitation. The coppice shoots which follow the first cutting are known as 'soca' and are cut after 8 years. The third and last crop, known as 'resoca' is obtained 5 years after the second. Further crops are generally poor, and it is advisable to replant after the 'resoca'. On longer rotations, selective cutting is practised.

21.1. *Light and Temperature Requirements*

[181]. 21.11 : 11.15 : 12.11. SHIRLEY, H. L. **Light as an ecological factor and its measurement. II.** *Bot. Rev.* 11 (9), 1945 (497–532). [New York State College of Forestry.]

A review [supplement to an article in *Bot. Rev.* 1, 1935 (356–82)] of light measurement technique and devices; the effect of light duration and intensity on plant growth; light requirements for photosynthesis; and interrelationship between light and temperature, mineral nutrition, water, etc.; and the influence of light on plant succession.

Light intensities beneath leafless hardwood canopies represent roughly 55 per cent. of full sunlight, decreasing progressively, as the leaves unfold, to 1–5 per cent. Intensities beneath Pine canopies vary with age and density of the stand. Minimum values for Jack Pine (15 per cent.) occur at 30–60 years of age. Light intensities beneath tropical canopies may be between 2 and 1 per cent. of full sunlight.

Within the visible region of the spectrum photosynthesis appears to be almost directly proportional to the amount of energy absorbed by the photosynthetically active pigments. A proper balance of red and blue light is necessary for normal plant development. Less than 1 per cent. of the energy which leaves absorb is used, but light intensities of 1 per cent. are far from adequate for maximum photosynthesis. Throughout the range from 1 to 15 per cent. of full sunlight, photosynthesis is almost directly proportional to light intensity, provided that other factors essential for rapid photosynthesis are favourable. Solarization and actual injury occur, however, at very high light intensities. The failure of small seedlings on the forest floor to take advantage of the increased light following logging is due in part to the suddenness of the change and to the differences in structures of leaves developed in shade from those developed in full sunlight. The capacity of some plants to achieve a maximum rate of photosynthesis at lower intensities than others may be of some ecological significance and may account for the ability of hardwoods to invade Pine stands and not *vice versa*. Vegetation beneath forest canopies tends to disappear at light intensities below 4 per cent. of full sunlight, but the density required to exclude herbs beneath deciduous canopies is considerably higher than that required beneath evergreen canopies, owing probably to the start such plants can get in the spring before the hardwood leaves are fully developed. Light intensity probably becomes a dominant factor in plant succession in open areas only when the plant cover has reached a density sufficient to reduce light intensity to below 20 per cent. of full sunlight. Inadequate nutrient and moisture supply and inadequate protection against moisture loss, extremes of temperature, unstable soil and wind action may be much more important factors in restricting early colonization. It is only with the advent of woody plants that shade begins to play an important role in succession. Closely related to natural succession are the successions artificially induced when foresters plant trees on lands occupied by other associations. Experiments on the relative importance of light and root competition in determining seedling establishment and the course of natural succession beneath forest canopies have shown that at each light intensity growth can be increased by decreasing root competition, and at each level of root competition, growth can be increased by increasing light. The increase in the growth rate was never as great where only one factor was improved as where both were improved.

[182]. 21.1 : 21.2 : 12.25. Oosting, H. J., and Kramer, P. J. **Water and light in relation to Pine reproduction.** *Ecology* 27 (1), 1946 (47–53). [Duke Univ., Durham, N.C.]

Seedlings of several species of Pine often become established along the margins of forests in the Piedmont, though rarely inside a stand. Sampling of the soil along transects from open fields across these margins into the interior of stands of Shortleaf Pine [*Pinus echinata*] showed that available water at the margin is as low as within the stands. Measurements of various atmospheric factors indicate no environmental differences between margin and interior of the forest which are likely to be significant for the establishment of Pine, except the value of light intensity, which is much higher at the margin. More successful establishment of *P. echinata* (and probably of *P. taeda*) at the margin of a forest than in the interior is probably related to the higher light intensity. *From authors' summary.*

21.3. *Soil Requirements*

[183]. 21.3 : 12.11.12 : 12.26–8 : 12.25. Connecticut. **Connecticut Agricultural Experiment Station: report of the Director for the year ending October 31, 1944.** *Bull. Conn. agric. Exp. Sta.* No. 484, 1945 (55–103).

Under average conditions, uncultivated forest trees obtain most of their nutriment from the top 6–10 in. of soil, which contains by far the largest proportion of available nutrients, especially nitrogen. In order to discover whether trees can obtain their nutrients from the lower depths in the soil, provided that the material is present in available form, hybrid Poplar cuttings were grown in an inverted profile. At the end of the second season, cuttings grown in the inverted soil had produced about twice as much growth as those grown in normal soil. The differences are considered to be due to the greater availability of material in the buried top soil because of the more favourable moisture conditions at that depth (23–28 in.). Also the normally unavailable plant food in the subsoil may have become partially available when placed at the surface where there is better aeration. Poplars growing in all topsoil (38 in. deep) were 4 times as large as those in normal profiles. These results indicate that trees can be fed by the deeper roots and that this species responds to an abundance of available nutrients.

Rooted cuttings of White Pine, with a maximum growth of 6 in. (compared with about 4 ft. in Poplars) could not show much difference at this stage. Those on the inverted profiles tended to be largest but the differences were not significant. Competition from the Poplars may account for the relatively poor growth on all topsoil (pp. 77–8).

21.6. *Behaviour in the Stand*

[184]. 21.6 : 12.26–8 : 24.2 : 12.11.3 (489). Bornebusch, C. H. Vokserum og Oprensning. **[Growing space and natural pruning.]** *Dansk Skovforen. Tidsskr.* 27 (1), 1942 (77–80). [Dan.]

It is shown graphically that whereas there is a close correlation, for some Danish Beech stands, between the 'bole quotient' (bole length/height) and the 'crown quotient' ($\sqrt{\text{available horizontal growing space per tree}}$/height), the former decreasing and the latter increasing with increasingly heavy thinning, the same is not true for the 'clear-bole quotient' (length of clear bole/height), which appears to be determined by the selection for form practised in making thinnings in genetically heterogeneous material. Natural pruning is thus not correlated primarily with growing space unless the stock is genetically uniform, and the existence in Denmark of a growing stock that is very mixed in genetic quality is possibly one of the reasons for the favour which heavy thinning has gained there. [Cf. *For. Abstr.* 5 (255).]

[185]. 21.61 : 31.27 : 52.3. Opatowski, I. **On the form and strength of trees. I. The trunk. II. The primary branches. III. The secondary branches and their relation to the primary branches.** *Repr.* from *Bull. Math. Biophys.* 6, 1944 (113–8, 153–61); 7, 1945

(1–4). [Armour Research Foundation, Illinois Institute of Technology, Chicago.]

The theory of strength of materials and known experimental relations between the strength and the specific gravity of green wood are used to derive relations between some geometric characteristics of the tree. The main purpose of Part II is to relate the shape of the branch to its strength and to explain by theory why a tree has a large number of branches. The secondary branches (dealt with in Part III) are considered mainly for the purpose of applying the principle of maximum strength to the primary branches. *From author's summaries.*

21.8. *Phenology*

See also *For. Abstr.* 8 (No. 289).

[186]. 21.8 (410) : 05.3 : 13.15. GUNTON, H. C. **Report on the phenological observations in the British Isles from December, 1944 to October, 1945.** No. 55. *Suppl.* to *Quart. J. R. met. Soc.* 72, 1946. (PR1–43 + dgms.)

[187]. 21.8 (68.9). NYASALAND PROTECTORATE. **Annual report of the Forestry Department for the year ended 31st December, 1944.** Govt. Printer, Zomba. [1945]. pp. 12.

Some gregarious flowering of the common Bamboo (*Oxytenanthera abyssinica*) has taken place in certain restricted areas of the Central Province. One of the areas was noted as not having flowered when the great part of the Bamboo forests of the Protectorate did so from 1924 to 1928. The present flowering seems to be out of step with the main cycle. The study of Mlombwa (*Pterocarpus angolensis*) is being extended with a view to ascertaining whether or not the periodic flowering and dying of Bamboos has any influence on its regeneration, i.e. owing to the temporary removal of shade over comparatively bare soil containing seedlings of the species (p. 3).

[188]. 21.8 : 45. MACKENZIE, J. M. D. **Periodicity in reproduction.** *Emp. For. J.* 24 (2), 1945 (229–30). [Tullach Ard, Balbeggie, Perthshire.]

Examples are given of food-chains and population increases in forest communities, e.g. (*a*) Bamboo seeding in Burma—jungle fowl (larger egg clutches), and rats and squirrels—feline predators; young Bamboo—deer and pig—tiger. (*b*) Teak defoliators in Burma—insectivorous birds (larger egg clutches). (*c*) Protection of blaeberry against rabbits and sheep in Perthshire—defoliation of Larch. The causes of gregarious flowering of Bamboo and periodic seed years of forest trees are discussed with the inference that meteorological and physiological factors are not the primary causes. Records of observations on high numbers (seeding or pests) and consequent chains of abundance are invited.

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

[189]. 22 : 32.2 : 12.26–8 (74.8). TAYLOR, R. F. **A comparison of silvicultural marking and cutting practice rules in a northern hardwood stand.** *J. For.* 44 (1), 1946 (41–6). [Northeastern For. Exp. Sta., Philadelphia 7, Pa.]

Field studies of the results of cutting under three cutting-practice rules and under good silvicultural marking, convinced the author that the use of such rules is well worth while. Although obviously makeshifts, they prevent ruinous cutting and pave the way for more intensive practice. The data are presented in a series of tables comparing results under the 4 systems.

22.1. *High Forest Forms*

[190]. 22.12.1 : 57 : 66 : 76. BUNDY, O. En häradsallmänning och några reflexioner över skogsvård med anledning av dess skötsel. **[A district common and some reflections on forestry arising from its silvicultural treatment.]** *Svenska SkogsvFören. Tidskr.* 42 (6), 1944 (434–56). [Sw.]

From data on growing stock and increment in mixed coniferous forest on the Oppunda (Södermanland, Central Sweden) commonland it is concluded that with natural regeneration under shelterwood (opening canopy at 90 yrs., regeneration being obtained in 5 yrs. and the overwood removed over two further 5-yr. periods) and given equal representation of age classes 0–100, such forest should have an average growing stock and increment (per ha. per yr.) of 142 and 5·4 cu.m. respectively for site quality 6 (ideal). This would represent 10 per cent. higher volume yield with 3 per cent. less growing stock than at Högsjö, in the same region, where the yield has been regarded as very good. Taking into account the value of the regeneration obtained gratis, the value yield of the shelterwood stage is satisfactory. If all age classes were equally represented at Oppunda, the yield on a 105-yr. rotation would be 4·9 per cent. of the stumpage value of the growing stock. It is considered that shelterwood fellings of this type, leaving the best Pine to produce valuable large-dimension timber, can be a profitable form of management for sites comparable to Oppunda.

The difficulty is emphasized of deciding what is the optimum growing stock for a particular site quality and age, and the need is urged of auxiliary tables to provide a more objective basis for such decisions.

[191]. 22.14.1 : 22.83 : 57.0 : 12.19.2. Leibundgut, H. Waldbauliche Untersuchungen über den Aufbau von Plenterwäldern. **[Silvicultural investigations on the structure of selection forests.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 24 (1), 1945 (219–96). [G.g.f.]

The copious and diverse data on which this study is based are summarized in 22 numerical tables and 17 diagrams. Its object is to elucidate the vertical structure and social composition of typical Fir, Spruce and Beech selection forest. The ideal selection forest, with its real advantages, is closely identified with the area of distribution of Beech forest rich in Silver Fir, and with the true Fir forest in the Alps and the Jura.

The total height and social class of 12,821 trees of 4 cm. diam. and over were determined in 8 stands occupying in all 17·3 ha.; the level of origin of the crown was determined for 11,321 trees in 6 stands. It was found that: (i) in most stands height distribution is very uneven; in well stocked areas and on poor sites the middle strata are relatively poorly filled; (ii) the social structure is particularly characteristic in the stands analysed; the ideal vertical arrangement can be maintained permanently, even in a selection forest, only where there is an overlap of the optimum conditions for those species which, because of their shade tolerance, are suitable for selection forest; (iii) both height and taper curves depend not only on the site but largely on the structure of the stand and the social classes of the trees; Spruce and Pine behave differently in this respect owing to their dissimilar light requirements, but in both species the middle-storey trees tend to be more slender than the dominants; it is only after reaching mature age that the differences due to site factors are clearly reflected in the height curves; (iv) the length of clear bole depends chiefly on the structure of the stand; the mixed storeyed selection type or single-tree system (Einzelplenterwald, Mélange par pieds d'arbres) is comparatively unfavourable in this respect, because it is in the most ideal selection type with the most perfect vertical arrangement that the crown length (relative to total height) reaches the greatest development; (v) the surface area of the canopy and the volume of the crowns bring out very clearly the characteristics mentioned in (i).

Burger's investigations of the relationship between increment and volume of foliage have thrown doubt on certain advantages of selection forest that are based on simple assumptions, particularly 'the complete occupation of the whole air space by actively productive foliage'. The present research shows that regular height distribution is probably the exception in selection forest and that the type in which mixture of species and age classes is achieved according to the generally accepted ideal single-tree structure (i.e. Einzelplenterwald, Mélange par pieds d'arbres) is by no means the best possible for the production of high-grade timber. The results also emphasize the cardinal importance of the principle of improvement by treatment, which cultural and economic considerations have already revealed, and justify a corresponding development of stands which, in some selection areas, depart appreciably from the single-tree system and approach more closely a group structure. Whether these cases can be called 'Plenterwald, i.e. Fôret jardinée' or 'Femelschlagwald, i.e. Fôret traitée par coupes progressives de caractère jardinatoire' depends entirely on the method of working adopted.

[192]. 22.14.2 (71.1). Weatherby, H. **Selective cutting in British Columbia.** *Pulp Paper Mag. Can.* 47 (2), 1946 (62–3).

The British Columbia Forest Service has been practising selective cutting in the interior of the State for some years on experimental plots of Engelman Spruce and Yellow Pine [*Pinus ponderosa*]. As a result of these studies it was concluded that, in Yellow Pine, 50 per cent. of the trees was the minimum amount which could be cut if the operator was to make a profit. This might be 75–85 per cent. by volume of the wood on the area since all mature and overmature trees are marked for felling. Selective cutting is not practicable on the heavily timbered coastal regions which consist largely of even-aged over-mature stands. Here a system of 'patch logging' [cf. *For. Abstr.* 4 (99)] is being used, and it is hoped that the danger of windthrow will be overcome by leaving the timber in fairly large blocks, and that natural reproduction will take place as it does on selectively cut areas.

[193]. 22.14.2 : 12.25 (77.4). DAY, M. W. **Spruce-Fir silviculture.** *Quart. Bull. Mich. agric. Exp. Sta.* 28 (1), 1945 (59–65). [Dunbar Forest Exp. Sta.]

The White Spruce/Balsam Fir/Paper Birch forest type is one of the most important sources of pulpwood, but the large area of this type which has been deforested or replaced by inferior species testifies to the ineffectiveness of common cutting methods to maintain the desired species. The main points of Spruce/Fir silviculture are as follows: (1) cut early, often and lightly; (2) protect young growth; (3) remove overtopping hardwoods. [Cf. *For. Abstr.* 4 (99, 256).]

[194]. 22.14.2 : 31.8 : 24.3 (76.5). REYNOLDS, R. R., and RAWLS, I. W. **Grade of material removed in first selection cut in Crossett Experimental Forest stands.** *Sth. Lumberm.* 171 (2153), 1945 (139–40).

On an area of 1,000 acres of second-growth Pine/hardwood in Crossett Experimental Forest, Arkansas, a first selection cutting yielded an average cut per acre of about 1,300 bd. ft. of merchantable sawlogs and about 4½ cords of pulp and chemical wood, much of it high-grade material, and gave a very satisfactory net financial return.

[195]. 22.14.2 (76.8) : 66. **A progress report on the Hassell and Hughes sustained-yield demonstration: appraisal of the first selective logging operation.** Department of Forestry Relations, Tennessee Valley Authority [Norris, Tenn.]. 1944. pp. 10.

An inspection report on the first selective logging operation on a sustained-yield demonstration. The tract contains about 290 acres of Shortleaf Pine forest. In the first cut, 204,000 bd. ft. of low-quality hardwoods and defective Pine lumber were harvested, leaving a stand of about 1,500 bd. ft. per acre. Seedlings and advance reproduction are well established over most of the area, and with continued good management this tract will produce 160 bd. ft. and more per acre from now on.

22.2. *Coppice Forest*

[196]. 22.2 : 12.26–8 : 33 : 76. MUIR, W. A. **Cultivation of Chestnut coppice and its utilization in war and peace.** *Forestry* 19, 1945 (74–85). [Forestry Commission and Ministry of Supply.]

This article deals primarily with Spanish Chestnut (*Castanea sativa*) coppice in Kent, Surrey, Sussex and Hampshire. The chief defects of cultivation and management are reviewed and suggestions made of the principal improvements which could and should be effected. Present defects are difficulty of extraction, presence of standards, inadequate stocking, coppice of mixed species, careless cutting resulting in a badly shaped crop at the next rotation, lack of drainage, damage by frost, and cutting out of season. It is suggested that by ensuring full stocking of comparatively narrow areas fronting on to roads or made-up tracks, an equal amount of material could be economically produced and the hinterland could be released for more valuable high forest, for which the coppice would also provide good fire protection. The problem of converting some of the excess acreage of coppice to high forest is discussed, and an account is given of utilization of Chestnut coppice, labour costs and financial returns. It is concluded that well stocked, pure Chestnut coppice, reasonably well placed, will continue to command prices which offer a really good return on the land utilized.

22.6. *Changes of Silvicultural System*

[197]. 22.6 : 23.24 : 12.25 (41.1–4) : 23.5 : 12.26–8 : 23.22. WATT, A. **Conversion of Birch scrub areas to coniferous woodland in the north of Scotland.** *Forestry* 19, 1945 (62–6). [Forestry Commission.]

A general note on Birch scrub in the north Highlands is followed by a description of five methods employed in the conversion of Birch-scrub areas to conifers. The methods are 'even thinning', 'group', 'Anderson group', 'strip', and 'clear felling'. The treatment of the scrub crop in the use of each of these methods is described, and the system of planting and the subsequent treatment necessary are referred to. A list of the species used for planting is given, together with notes on their individual suitability. The choice of methods is discussed and the opinion expressed that group methods are on the whole the most desirable on silvicultural, economic and amenity grounds. *From author's summary.*

22.8. *Silvicultural Description of Forms of Stand*

[198]. 22.83 (489). SABROE, A. S. Blandskov. **[Mixed forest.—**With discussion.] *Dansk Skovforen. Tidsskr.* 27 (5), 1942 (213–32). [Dan.]

Though no detailed mensurational data are available for mixed stands in Denmark, the author believes that mixtures may often be advantageous in the interest of soil improvement, better utilization of the available space and site conditions, and provision of a reserve against damage to the main crop. For Oak, an underwood of pure Beech is undesirable, and Sycamore Maple, Horse Chestnut, or (best) Ash, with individual trees of Beech, are to be preferred. Ash is thought to be best in more or less uneven-aged mixture with Sycamore Maple and some Beech. For Beech, Oak and Larch are well fitted to fill occasional gaps. For Silver Fir, Beech in groups appears to be desirable, and for Norway Spruce, groups of Beech occupying up to 10 per cent. of the area are almost certainly so.

In discussion, Holten mentioned Beech with some Larch as a favourable mixture; Mundt regarded Sycamore Maple as a serious weed and suggested Lime as an admixture for Ash. [Cf. *For. Abstr.* 8 (No. 753).]

23. FORMATION OF STANDS

23.1. *Natural Regeneration*

[199]. 23.1 (41.1–4) : 64 : 45.1 : 21. MCNEILL, W. M. **Preliminary observations on the influence of site conditions on natural regeneration, with special reference to Dunecht Estate, Aberdeenshire.** *Forestry* 19, 1945 (41–55 + plates). [Forestry Department, Univ. of Aberdeen.]

On Dunecht Estate natural regeneration of tree species is never profuse except where all browsing animals have been totally excluded for a considerable period of time, when natural regeneration, especially of Beech and Silver Fir, occurs freely. Data collected suggest that, in the climatic conditions obtaining, the unfenced portions of the woods would regenerate themselves freely if all browsing animals were excluded, provided that the percentage of broadleaved trees to conifers be not less than 25 per cent., and provided that the seedbearers contain at least 15 per cent. Beech and 10 per cent. Silver Fir. In predominantly coniferous stands with a heath or grass/heath surface vegetation there is no evidence to show that complete exclusion of animals alone would result in a crop of coniferous regeneration, though there are indications that it would substantially increase the chances of survival. The most favourable conditions for regeneration of Scots Pine are a sandy or gravel soil, dry conditions, and full or almost full light. Norway Spruce will regenerate in *Calluna/Vaccinium* surface vegetation, provided it has sufficient lateral shade and soil moisture. The proximity of seedbearers and their position in relation to the prevailing winds at seedfall and to the topography are important. The presence of grass in the surface vegetation lessens the chance of establishment of all species of conifer. Where Heather is the dominant component of the surface vegetation, there is little Scots Pine regeneration until the Heather clumps have reached a fair age and open out from the centre. *From author's summary.*

[200]. 23.1 (42.1–8) : 23.23.1 : 23.61 : 24. BOURNE, R. **Neglect of natural regeneration.** *Forestry* 19, 1945 (33–40).

A review of the practical problems rising out of the unusually heavy Beech and Ash regeneration in England in 1945. If special steps are taken to protect exposed seed in selected areas due for regeneration, foresters must be prepared for abnormal destruction by birds and rodents in the immediately surrounding area. Observations show that where litter was not too deep and was reasonably dry, Beech seedlings were well rooted in mineral soil, but where a mat of wet leaves lay beneath the litter, many of the seedlings remained unrooted in mineral soil though they had radicles 2–3 in. long. Where extraction operations of timber and topwood were not completed by the end of March, further removal caused great destruction of seedlings. Where the felling was not commenced before November, after the nuts were ripe, and where the extraction was completed or was stopped before the end of March, such operations did not greatly affect the establishment of seedlings, and where moist litter and brambles were previously present, these operations actually increased the number of seedlings well rooted in the mineral soil. By timely timber operations in a Beech-mast year, the chances of natural regeneration can be increased in bramble areas or in closed woods with deep wet litter. Late frosts in April were very destructive of seedlings in the open, and clearly, in this country, Beech woods should not be opened too heavily in advance of a mast year. On the other hand, adequate light is clearly the essential need for the proper development of Beech seedlings. Lack of soil moisture is only to be feared on the driest soils or in exceptional drought.

The exceptional Ash regeneration appears to be from dormant seed of the Ash seed year of 1939. It is believed that the severe frosts at Christmas 1944 were responsible for this phenomenon, penetrating the soil everywhere to a depth of several inches and cracking the seed covering. The majority of Ash seedlings were well rooted in the mineral soil, even in deep litter. Very little regeneration was killed by the late frosts in April and May. When it is remembered, also, that Ash seed is produced abundantly by both old and young trees, more frequently than Beechmast, it is evident that the problem of Ash regneration is far less complex than that of Beech.

In order to assist in the establishment of this natural regeneration, the necessary measures are weeding, opening of the canopy to let in more light, and care in felling operations. In order to minimize damage from early morning sunlight after frost, and yet to get the necessary side light, extra light can best be provided by relatively narrow strips running north and south. Too much light must not be let in to a forest floor clean or relatively clean of weeds, in advance of regeneration. In cases of intermittent seed production, as with Beech in England, it is often necessary to cut more than the increment in the seed year and immediately succeeding years.

[201]. 23.1 : 12.25 (493). BOUDRU, M. Quelques notes sur la régeneration naturelle des résineux. **[Some notes on the natural regeneration of conifers.]** *Bull. Soc. for. Belg.* 52 (1–6), 1945 (34–42). [F.] I.M.I.

The article consists mainly of résumés of articles by Hesselman (1938) and Petrini (1934) on natural regeneration of Pine and Spruce in Sweden, and some indication of how methods which have proved satisfactory in Sweden might be adapted to conditions in the Ardennes.

[202]. 23.1 : 43 : 12.25 (71.1). **Reports of research standing committees, 1945 [Canadian Society of Forest Engineers]: silviculture.** *For. Chron.* 22 (1), 1946 (73–82).

An extensive check has been made on the state of the cut-over lands in the White Spruce type of the Upper Fraser Valley in British Columbia. Utilization has been more or less continuous for 30 years. (1) *Burns*: most areas of virgin forest which were once burned are reproducing satisfactorily. (2) *Logged and burned*: small areas ideally situated with respect to surrounding timber are reproducing satisfactorily, but the burning appears to have set the area back about 40 years compared with unburned logging. Re-burns are definitely unsatisfactory. (3) *Logged*: unburned, logged areas will develop a second crop of Spruce naturally from the residual stand and advanced growth surviving the logging. Twenty to thirty years after logging there are about 50 Spruce trees per acre over 6 in. d.b.h. These trees are sufficient to produce a second crop, and show rapid growth indicating a cutting cycle of about 75 years. Spruce appears able to dominate the Balsam which acts as nurse crop. The virgin stands average about 50 Spruce trees per acre over 8 in. d.b.h., of which about 35 are logged at present. Standard logging practice has produced satisfactory results, except where indiscriminate cutting has increased the size of natural openings; marking should be so done as to avoid increasing the size of natural openings and to provide a residual stand (pp. 73–4).

[203]. 23.1 : 12.25 : 32.29.2. ISAAC, L. A. **Reproductive habits of Douglas-Fir.** Charles Lathrop Pack Forestry Foundation, Washington, D.C. 1943. pp. 107.

In the important Douglas Fir region of western Washington and western Oregon, a large proportion of the lands cut over in the last 20 years have failed to re-stock satisfactorily; this is due partly to uncontrolled fire and partly to other factors. Douglas Fir produces seed abundantly, with complete crop failures only every 4th and 5th year, but much seed is destroyed by rodents, birds, and fire. Few seeds retain their viability on the forest floor for more than one year. Seedling establishment is governed by a number of factors. A maximum surface soil temperature of 125° F. is fatal to young seedlings. Spring frosts, summer droughts, frost heaving, disease, insects and animal predators all kill some, so that only a very small proportion of germinated seeds results in established seedlings. Shade protects the seedling from some of these unfavourable factors, but young Douglas Fir can at no stage endure full overhead shade such as that cast by a virgin forest or very dense ground cover. A controlled study of shade indicates that Douglas Fir reproduction has little or no chance of successful establishment in anything less than 20 per cent. of full overhead light, even where there is no root competition. Under timber cover, it will probably not thrive in less than 50 per cent. of full overhead light.

The grazing of livestock for a period of 5–10 years on cut-over land not sown to grasses, is considered an acceptable practice of forest management which will be harmless to the tree regeneration, provided the grazing is light and carefully administered.

Douglas Fir seedlings grow very little in the first 3 or 4 years, and even the dominant seedlings do not reach a height of 5 ft. until about 9 years of age on the average site. Seedlings in a light weed cover were found to grow twice as fast as those in a heavy brush cover. If an average of 8 seed trees per acre is left, it is probable that 4 or more will survive for a period of 6–10 years, which should be adequate for reseeding. More than 8 large trees is likely to be unfavourable to young growth. When the exigencies of fire prevention, or the existence of excessively heavy cover or debris dictate it, slash burning should be done; otherwise not. Burning tends to favour Douglas Fir reproduction in competition with Hemlock, Cedar, Spruce and the Balsam Firs, particularly after partial cutting. But slash disposal in general is extremely difficult following partial cutting, and may do more harm than good. *From author's summary.*

[204]. 23.1 : 12.25 : 12.19.2 (64). Huré, B. La cedraie du moyen Atlas morocain. **[The Cedar forests of the Middle Atlas Mountains of Morocco.]** *Rev. Eaux For.* 83 (12), 1945 (706–18); 84 (1; 2), 1946 (1–10; 79–92 + plates). [F.]

The Moroccan Cedar (*Cedrus atlantica*) forms large stands (a total of some 81,000 ha.) in the Middle Atlas mountains of French Morocco. The present article gives a detailed account of the species and of the Cedar forests, which often have an understorey of Holm Oak (*Quercus ilex*) which becomes dominant on unfavourable sites or towards the lower limit for the Cedar (1,600 m.). Large flocks of sheep and goats graze in these forests and are a serious danger tó regeneration. The mean volume per hectare is estimated at 300 cu.m. The forests were heavily over-exploited during the war. Regeneration seems to depend on exclusion of fire and grazing, and a series of rainy years. The Forestry Service employs the following methods to induce regeneration: regeneration fellings, liberating seed trees at the expense of dominated and badly formed individuals, cutting back and burning of Holm Oak and other secondary species. The burning is done on numerous spots at frequent intervals. After exploitation, the stand has the appearance of a pure, open stand of Cedar, with numerous burnt patches of ground covering about one-tenth of the surface. If these patches are suitably distributed it is sufficient that each should carry 3 or 4 seedlings for regeneration to be complete at the end of a few years. This method was employed during the war on nearly 1,000 acres and seemed to be giving partial regeneration in 1942.

[[205]. 23.11 (66.9). Nigeria. **Annual report on the forest administration of Nigeria for the period 1st January, 1944 to 31st March, 1945.** Govt. Printer, Lagos. 1945. pp. 47.

The natural regeneration technique known locally as the Tropical Shelterwood System was expanded over additional areas. Regeneration counts taken in treated areas indicate good promise of success. The main difficulty is caused by the profuse growth of Iloi (*Acacia pennata*), which appears and multiplies as soon as the middle-storey canopy is thinned, and threatens to overtake the natural regeneration of economic species and smother it. Unfortunately the light conditions required for the development of desirable species seem to be most favourable to the appearance and growth of Iloi. Experiments are in progress to determine whether it is more economic to leave unregenerated the patches of forest in which Iloi is abundant, or to undertake systematic uprooting (p. 11).

[206]. 23.13 : 12.25 : 23.22.1 (485). SJÖSTRÖM, H. Markberedning som hjälpmedel vid skogens föryngring i Norrland. [**Soil cultivation as an aid to forest regeneration in Norrland.**] *Svenska SkogsvFören. Tidskr.* 42 (3; 4), 1944 (187–96; 282–92). [Sw.g.]

In contrast to S. Sweden, where patch cultivation has long been used to encourage natural regeneration, it is only in recent years that this method has been tried on any considerable scale for the difficult mor types at higher altitudes in Norrland, where Norway Spruce is often dominant on sites that would give better yields under Scots Pine. The low proportion of the latter frequently makes the supply of seed of suitable provenance a serious problem, especially since Pine seedbearers are often killed where burning is practised. Pine, however, is a more reliable seedbearer in the relatively unfavourable climate of this region than Spruce; after liberation of the crown it will seed more or less every year, though in no great quantity, whereas seeding of Spruce is more limited to certain good seed years, in addition to which Spruce seed is more liable to damage and more exacting as regards the soil types and moisture required for germination. In old stands in need of regeneration, it is of great importance that the crowns of Pines suitable as seedbearers should be carefully released during the later intermediate fellings, so that they are in good condition when regeneration fellings take place. Large-scale trials of soil cultivation during the last 10–15 years have shown that Pine regeneration is much easier to obtain by this treatment, provided that sufficient seedbearers are present, than is that of Spruce, which in the pronounced mor types must usually be regenerated artificially after clear felling and burning. Kolmodin's experiments at Orsa, in Dalarna, showed that Pine regeneration was best, as regards both number of plants per unit area and height growth, on patches from which ground vegetation and humus were carefully removed with no loosening of the mineral soil, as the latter increased the risk of frost heaving that usually exists on soils with a high proportion of fine particles. Dusting with sodium chlorate [cf. *For. Abstr.* 7 (Nos. 2030–1)], in combination with soil cultivation, greatly improved regeneration as compared with untouched plots and those given the chlorate treatment alone. Studies on different soil types have shown that conditions are most favourable to regeneration along the margins of the cultivated patches, hence the patches should be oblong in shape, though their breadth must be decided by the nature of the ground vegetation and by the need for them to remain receptive to natural seeding for several years in succession. If sufficient Pine seedbearers are present, it should be possible to carry on soil cultivation from year to year, thereby utilizing labour better than if operations are concentrated upon the good seed years. Less expenditure of labour is necessary if cultivation is done in spring or autumn, rather than about midsummer when the soil is dry. An excellent tool for deep mor is the Mo-and-Domsjö mattock, with which a vertical side to the patches can be cut when the latter are marked out, the vegetation and humus being removed afterwards. Where the going is good, modern wheeled cultivators, which are designed to expose as large an area of soil as possible rather than to secure deep cultivation, may be used to reduce costs. [Cf. *For. Abstr.* 8 (Nos. 208, 699).]

[207]. 23.13 : 12.25 : 32.29.2. NOAKES, J. W. **Effect of different methods of slash disposal on Jack Pine reproduction. Project P–126, Petawawa Forest Experiment Station.** *Silvic. Res. Note Dom. For. Serv.* No. 78, 1946. pp. 8.

It was found, in the studies described in this bulletin, that if logging slash of Jack Pine was placed close to the ground, a large percentage of the cones opened quickly during the summer, and a large quantity of seed was made available; also that, with current methods of cutting and slash disposal, i.e. clear cutting and burning, a very large percentage of the cones on the slash was being burned, and that in many cases the number of cones remaining was insufficient for adequate re-stocking. Consequently, other methods of slash disposal were tried, and it was found that the lopping and scattering of slash, so that it did not exceed one foot in height from the ground, gave very good results as far as cone opening was concerned, and at the same time held fire danger at a low level. Further research proved that these provisions were not always sufficient to ensure re-stocking of the stand, and that, in the final analysis, the condition of the seedbed was the critical factor; if sufficient mineral soil was exposed on the forest floor, immediate reproduction was assured, providing always that sufficient seed was available. Further work to be done on this project includes cone-opening counts to determine the percentage of cones unopened at the end of the first year, which will open during the second year. [Cf. *For. Abstr.* 8 (No. 329).]

23.2. *Artificial Regeneration*

[208]. 23.2 (485) : 07.7. JUHLIN DANNFELT, M., ELGSTRAND, A., et al. Erfarenheter av skogsodling. **[Experiences with artificial regeneration.]** *Svenska SkogsvFören. Tidskr.* 42 (2), 1944 (82–131). [Sw.]

In these two lectures and the ensuing discussion several contributors were of the opinion that planting is likely to increase in favour compared with direct sowing, particularly in view of probable seed shortages combined with growing concern about seed origin and the possibilities of the tree-breeding programmes now under way in Sweden. The chief points discussed were: (i) *Planting stock*—Selection for quality and vigour by roguing nursery stock was generally felt to be desirable. M. Juhlin Dannfelt referred to experiments (*a*) at Kolleberga, where, 2 years after transplanting, Red Oak seedlings selected for vigour were about 1 m. high whereas seedlings inferior at the start had only reached a few decimeters; and (*b*) in Östergötland, with Birch seedlings sorted into 3 size classes, the smallest of which mostly died subsequently, while the largest continued to show the greatest vigour. M. Enander quoted longer-term experiments (*a*) with 2/2 Silver Fir planted in 1920 in Omberg Crown Park, where a revision in 1943 showed a considerably higher survival and better height and diameter growth for initially strong plants; (*b*) with 'plus-variants' and medium-good 2/1 stock of Siberian Larch, Scots Pine and Norway Spruce, planted in 1934 at Rö (Stockholm county), where in 1944 the 'plus-variants' were respectively 59, 29, and 82 per cent. higher than the medium-good stock, in addition to which their height was more uniform and their stems were straighter and showed less damage; (*c*) with plants derived from seed of wolf trees and from seedbearers that had been codominants with straight stems and good natural pruning; seedlings of the latter were already smaller on the average when planted out at Näs (Rö parish) in 1925, and up to 1944 the progeny of the wolf trees showed better survival, more uneven growth but somewhat better quality and yield. H. Sjöström recorded good results in several parts of Norrland from the use of Scots Pine and Norway Spruce wildings from roadside banks, where natural selection must already have operated with some severity and further selection could be made when lifting the plants, which is done with a large knife, excess soil being shaken off lightly, the plants placed in a bucket with a little water until enough are ready for bundling, and roots pruned if too long. In stands of good racial quality it would possibly be worth while to prepare the soil of such banks at suitable intervals [cf. *For. Abstr.* 8 (No. 61)]. Root pruning was recommended by Juhlin Dannfelt for Scots Pine (not for Norway Spruce) and hardwoods, a good method being pruning *in situ* with a sharp spade in August of the first year or early in the following spring.

(ii) *Spacing*—Both lecturers were opposed to spacings much wider than the normal. In S. Sweden it might be possible, given good repairing of blanks and good tending, to increase the spacing for Norway Spruce somewhat beyond the normal 1·2–1·3 m. In N. Sweden it is necessary to have at least 3,000–3,500 seed patches or planting pits per ha. for Norway Spruce and Scots Pine. M. Näslund quoted provisional results from a 37-year trial of Scots Pine planted or sown at different spacings in Granvik Crown Park, Västergötland, which showed that (*a*) a spacing of about 1·50 × 1·50 m. gave the maximum total yield exclusive of self-thinning; (*b*) 1·25 × 1·25 m. (the spacing usual in Central and S. Sweden) gave the best value (quality) yield; (*c*) at 1·50 × 1·50 m., sowings yielded 23 per cent. less than plantings, a difference likely to increase as thinnings eliminate group effects in the former; natural pruning was better in the sowings but owing to the late incidence (25 years) of the first thinning there were more crooked stems, etc., and quality was in general worse, hence sowings do not appear to give good results in the absence of earlier tending, which would add to costs. [Cf. *For. Abstr.* 8 (Nos. 234, 241).]

(iii) *Season*—The chief adverse factors to be considered are early summer drought and frost-heaving in winter. (*a*) *Sowing*: Juhlin Dannfelt, for S. Sweden, gave the best times for conifers as either early spring or else early summer; among hardwoods, Maple and Birch give good results from autumn sowings, but owing to the risk of mast being eaten, Oak and Beech are better sown in spring [cf. *For. Abstr.* 7 (Nos. 1723, 1749)]. In Norrland, early summer is regarded as a good time for conifer sowings, and autumn as undesirable on the whole, though suitable for the preparation of the ground if labour is available. (*b*) *Planting*: Juhlin Dannfelt reported that at Kolleberga transplanting of 2-year Norway Spruce at the end of July had given 3-year stock practically equivalent to 2/2 stock with normal spring transplanting. Planting-out in August had given good results at Kolleberga with 2/2 Norway Spruce and in Örebro with 2/2 Norway Spruce and hardwoods; this method should be worth trials elsewhere, as the risk of frost-heaving is almost eliminated. H. Carbonnier considered summer planting risky, and, in common with some other contributors, stressed the reliability of autumn planting. [Cf. *For. Abstr.* 7 (No. 1174).]

(iv) *Technique and tools*—(*a*) *Sowing*: Juhlin Dannfelt mentioned the 'Trollebo method', for sandy soils and moraine soils too stony for the harrow, consisting in paring off the litter and humus from patches about 0·3 × 0·3 m. and, with no loosening of the soil, making a drill 2–3 cm. deep and 5 cm. long in which the seed is sown and left uncovered. This method has been used in Jönköping since 1933, is good against frost-heaving, and costs only one-third as much as ordinary mattocked seed patches. A Norwegian tool successfully tried at Kolleberga is 'Skredros såddhacka', a mattock with a seed container in the handle, the blade acting as a seed spreader. A. Elgstrand states that 'Berglind's automatic patch-cultivator and sowing machine' is capable of dealing with up to 8,000 patches, or about 2 ha. (assuming a spacing of 1·5 × 1·5 m.), per day. The Jämten and Widén forest ploughs are similar in efficiency. In Norrland, the soil is loosened only where serious frost-heaving is not expected; even so, loosening is done only to about 1 cm. depth, the seed being mixed into the loosened surface without treading. An application of up to ½ litre of ashes per patch is beneficial. In many places good results have been obtained by treading the soil and covering the seed with at most 1 cm. of sand or fine gravel. (*b*) *Planting*: Though a poor method in careless hands, bar planting can be a good one if properly done. Carbonnier stressed that the soil should be loosened before making the planting hole. Planting in open pits, generally against the pit wall or a wall made in the middle of the pit, is now a standard method. In S. Sweden, Oak and Beech are planted in narrow, deep-mattocked patches ½ m. long and spaced 1 × 1 m., and with 3 bar holes per patch. 2/2 Norway Spruce can be 'borer-planted' [cf. *For Abstr.* 8 (Nos. 238–9)]; gangs are paid by the piece, and where mattocking is done in advance of actual planting, the foreman's record of the number of patches made serves not only for pay purposes but also for planning the allotment of planting stock. Sjöström described a modified method of notch planting, using a special tool having a steel notching blade (25 cm. long, 10 broad and 1 thick) with a tubular handle provided at the other end with a saw-toothed mattock blade, the over-all length being 1·5 m. The procedure is: (i) probe for a good spot and pare off ground cover with the mattock end; (ii) make a single notch with the spade end, the planter inserting the plant and, with a stick, straightening roots and holding it against one wall while (iii) the spade is inserted a short distance away and even pressure applied to close the notch, after which the second hole is trodden in with the heel. This method has proved successful with Scots Pine and is probably suitable for deep rooters (not for shallow rooters such as Spruce); there is very little risk of frost-heaving and further trials for both spring and autumn planting are recommended.

[209]. 23.2 : 12.26–8 (75) : 4. Hopp, H. **Cork Oak in the southeast.** U.S. Soil Conservation Service. No. TP54, 1944. pp. 25.

Information on the growing of Cork Oak (*Quercus suber*) in the United States has hitherto been available primarily for California. This report gives the best available knowledge, based on a special survey, on the growth and adaptability of Cork Oak for planting in the South-eastern area. It is concluded that, though the climate and soils in large parts of the Southeast are suitable, and individual trees have grown to a considerable size and produced bark of apparently similar quality to that produced in Europe, research is necessary on soils, ecology, silvicultural treatment, and harvesting, before large-scale planting is undertaken. [Cf. *For. Abstr.* 8 (No. 574).]

[210]. 23.2 : 12.26–8 (54). Taggarse, P. M. **My impressions on the general principles of Teak plantation.** *Indian For.* 71 (9), 1945 (303–4).

The author expresses opinions on the general principles of raising Teak, that are contrary to general experience and the views assembled in *Indian Forest Records* (Silviculture) V, Nos. 1 and 2. He considers that (1) the growth of a Teak plantation after the first ten years depends mainly on the nature of the subsoil and the level of the water table; (2) deterioration of the soil is bound to result in one rotation of Teak and is avoidable only by growing another species in the second rotation; (3) exposure owing to clear felling results in soil erosion; (4) defoliation cannot be controlled by leaving broad strips of natural forest between plantations; (5) the formation of heartwood is slower in plantations than in natural forest and if it starts early its future is unpromising; (6) epicormics are caused by hard subsoil and their growth is stimulated by opening-up; (7) the main problem of Teak plantations is that of revenue and expenditure.

An editorial footnote points out that differences of opinion arise because the problem of pure Teak and the problem of growing Teak on poor areas are often confused.

23.22. Preparatory Work. Auxiliary Measures

[211]. 23.22.1 Denman, W. J. **Ploughing in the Highlands.** *Sylva, Edinb.* No. 26, 1945–6 (38).

Deep ploughing, preparatory to planting, is done on heather moors, with a large, strong, tractor-drawn plough which will go down 22 in. if necessary. Ploughing is done at intervals of 4 ft. 6 in., more or less in the direction of the main drainage, so that in wet areas each furrow can act as a drain. Ploughing aerates the soil, and sandy, gravelly soil, free from humus, is turned over on two layers of heather, moss, etc., thus creating humus in its proper position in the soil. To give time for this to take place and to allow the furrows to settle down firmly, it is advisable to plough 6 to 12 months before planting. The plants are slot-planted in the bottom, on the top, or in the side of the furrow, according to the wetness or dryness of the area. Probably planting in the side of the furrow takes most advantage of the effects of ploughing.

The quickness of establishment and subsequent growth, the almost entire absence of the need to beat up, the possibility of introducing more exacting species in the improved soil conditions, and the great encouragement of natural regeneration if there are seed trees in the neighbourhood, are among the advantages gained from ploughing. This method is also used in wet, peaty areas to drain, aerate, and so break down the peat into useful soil, and in dry, sandy soils where the plants are put in the bottom of the furrow to make the most of the available moisture. Great areas of the Highlands, previously considered unplantable except with much intensive and costly hand labour can now be planted at a reasonable cost with every prospect of success. [Cf. *For. Abstr.* 8 (No. 253).]

[212]. 23.22.1. **Disking saves the topsoil in forest planting.** *Tech. Note Lake States For. Exp. Sta.* No. 218, 1944. p. 1.

Preliminary tests of planting on disked soil indicate that disking may be one way of avoiding the problems created by ploughing. The Athens-type disk harrow effectively destroys competing vegetation and mixes and loosens the soil, but it neither throws the topsoil to the sides nor does it create objectionable ridges and furrows. Some measurements of the growth of 2–2 Red Pine, planted in both disked and furrowed areas about 200 acres in extent on the Chippewa National Forest, are given in the following table:—

Soil preparation	*Date of planting*	*Average height after 2 years*	*Survival after 2 years*
Furrowed . .	Spring 1940	0·80	89
Disked . . .	Spring 1940	1·24	96

The difference in growth reflects the difference in fertility of the disked and ploughed areas.

23.23. Sowings

See also *For. Abstr.* 8 (No. 28).

[213]. 23.23. Eneroth, O. Sådd. **[Direct sowing.]** *In* Skogsodling—Föredrag, hållna vid skogsodlingskursen å skogshögskolan den 23–26 april 1945. Svenska Skogsvårdsföreningens Förlag [Stockholm]. 1945. pp. 45–66. [Sw.]

A lecture on some of the considerations necessary to achieve optimum distribution of young stock in direct patch sowings of Pine and Spruce with the minimum expenditure of seed and work. A discussion of theoretical stock distribution on a mathematical basis is followed by sections on preliminary measures (e.g. treatment of residual stands and advance growth, burning), season of sowing and time to elapse after burning, age of site as an open area (in connexion with raw-humus decomposition), methods of patch sowing (chiefly seedbed conditions), quantity of seed per patch, and spacing of patches. The treatment is general, as the intention is to illustrate the problems and factors involved rather than to make specific recommendations.

23.23.1. *Seed Procurement, Treatment, and Testing*

See also *For. Abstr.* 8 (No. 28).

[214]. 23.23.1 (485) : 12.11.3. Forshell, W. P. Fröanskaffning och frökvalitet. **[Seed procurement and seed quality.]** *In* Skogsodling—Föredrag, hållna vid skogsodlingskursen å skogshögskolan den 23–26 april 1945. Svenska Skogsvårdsföreningens Förlag [Stockholm]. 1945. pp. 7–20. [Sw.]

A general discussion of the need for and progress of artificial regeneration in Sweden in the past, the present area in need of regeneration, measures for seed collection, and seed classification. [Cf. *For. Abstr.* 7 (No. 1722).]

[215]. 23.23.1 (485) : 12.25. Tirén, L. Om klängning, frölagring och grobarhetsbestämning. **[On extraction, storage, and germination tests of seed.]** *In* Skogsodling—Föredrag, hållna vid skogsodlingskursen å skogshögskolan den 23–26 april 1945. Svenska Skogsvårdsforeningens Förlag [Stockholm]. 1945. pp. 33–44. [Sw.]

Brief discussions of each of the subjects in the title, with particular reference to Pine and Spruce. Suitable extraction conditions for the former are temperatures of 45—50° C. for about 12 hours, and for the latter 45° for 8–10 hours or 50° for a rather shorter period. As moist seed is more liable to heat injuries, it should be dried at a lower temperature before extraction proper. The need for separate treatment of different provenances is emphasized. Storage is discussed, with the normal emphasis on storing seed dry, cool, and in air-tight vessels: under such conditions Pine and Spruce seed showed no significant reduction in germination per cent. over a period of 6 years and Pine seed has been so stored for 13 years without any serious reduction in viability. The standard 30-day germination test of the State Central Seed-Testing Institution is outlined and a rapid method of calculating germination per cent. from results after only 10 days is described. The equations used are—*Pine*: $y = 8{\cdot}0249 + 0{\cdot}8918x_1 + 0{\cdot}0022x_1{\cdot}x_2$; *Spruce*: $y = 2{\cdot}9736 + 0{\cdot}9576x_1 + 0{\cdot}0036x_1{\cdot}x_2$, where y = germination per cent. based on 100 seeds, x_1 = percentage of normally germinated seeds after 10 days, x_2 = percentage of sound ungerminated seeds after 10 days + any abnormally germinated seeds. It is hoped that this rapid method will soon be in use at the Institution named and that the functions may be further improved as statistical data accumulate. Stress is laid on the need for considering the germination per cent. when estimating quantities needed for sowing, and on the distinction between germination and plant per cents. In a small-scale experiment in 1944 the plant per cent. from viable seed was shown to decrease with age of seed. Tentative values for the number of differently aged Pine seeds necessary to give about the same number of plants as *n* viable, fresh seeds are—

Age of seed in years	*No. of viable seeds to be sown*
0	1·0 *n*
2	1·1 *n*
4	1·2 *n*
6	1·3 *n*
8	1·5 *n*
10	1·7 *n*

It has also been shown that 100 viable seeds of Pine will give about the same plant per cent. independently of the germination per cent. of the seed lot in a Jacobson germinator, whereas the plant per cent. from viable Spruce seeds decreased with decreasing germination per cent. of the original seed lot. Assuming (as nothing is known of the combined effect of age in this instance) that this decrease is the same for seed of different ages, the following provisional figures can be given for Spruce:—

Germination per cent. of seed sample	*No. of viable seeds to be sown to give equivalent plant per cents*
100	1·0 *n*
90	1·1 *n*
80	1·2 *n*
70	1·3 *n*
60	1·4 *n*
50	1·5 *n*
40	1·7 *n*
30	1·8 *n*
20	1·8 *n*

[216]. 23.23.1 : 12.25 (489). BORNEBUSCH, C. H. Dansk Lærkefrøs Brugsværdi. **[The practical value of Danish Larch seed.]** *Dansk Skovforen. Tidsskr.* 29 (1), 1944 (1–9). [Dan.]

Cf. *For. Abstr.* 8 (No. 174).

[217]. 23.23.1 : 12.25. STEFANSSON, E. Provklängning av tallkott sorterad i storleksklasser. **[Extraction tests with Pine cones sorted into size classes.]** *Skogen* 33 (7), 1946 (114–5). [Sw.]

Pine cones sorted into ½-cm. length classes (from 2·1–2·5 to 4·6–5·0 cm.) gave seed yields, in kg. seed per hl. cones, increasing from 0·44 for the lowest, through 0·79 for the 3·1–3·5 cm. class, to 1·00 for the highest class, the average for all classes being 0·76. Viability averaged 97 per cent. for all classes and did not vary significantly with class, hence it would appear that in the present seed shortage the use of cones giving a yield of 0·44 kg. per hl. could be justified. There is a possible objection in that the 1,000-seed weight, which previous research has shown to affect early plant development, was only 3·77 [g.?] for the lowest class, increasing to about 5·2 for the two highest classes. The material for the tests was derived from a stand in a relatively favourable situation for seed production, and a caution is given that differences in the seed yield by size classes are likely to be greater under more adverse conditions [cf. *For. Abstr.* 8 (No. 116)]. The smaller cones required a somewhat longer extraction period than the larger ones.

[218]. 23.23.11 : 12.25. **Reports of research standing committees, 1945 [Canadian Society of Forest Engineers]: silviculture.** *For. Chron.* 22 (1), 1946 (73–82).

The cone crop on Douglas Fir in 1945 was the best on record for Southern Vancouver and the southern coast of British Columbia. Large seed trees left after logging averaged well over 5,000 cones per tree, and 60 per cent. of 40- to 50-year trees in stands carried an average of over 3,000 cones. *Abies grandis* bore a very heavy crop: 50 per cent. of observed trees under 100 ft. high averaged 675 cones, and over 100 ft., 500 cones. Rapidly growing trees frequently cannot carry large crops in windy weather. The tops of two trees were measured on the ground after they broke in June when the cones were about half mature size. One tree was 16 in. d.b.h., 115 ft. high, and 48 years old. Most of the cone-bearing top, amounting to 2½ years' growth, fell to the ground bearing 650 cones, 2 × ¾ in. in size. On the other tree, about 30 years old and 11 in. in diameter, the cones were 3 × 1 in. when the top failed to sustain the load and broke at 2½ in. diameter in the 1942 internode. The growth in 1943 and 1944 was 7·2 ft., and on the last three nodes and two internodes there were 450 cones.

The size of crop is estimated on the same sample trees each year in order to obtain comparable records of quantity and periodicity. After counting all the cones visible from one side of a tree with 10 × 50 binoculars and multiplying by a factor (usually 2) for unseen cones, a table of the number of cones per tree for 6 grades of crop was made for Douglas Fir by site, height class, and light class (i.e. according to the portion of the crown exposed to sunlight). Recently a number of crops on check trees have been picked; these have shown that counts by different observers are very consistent, but only about one-quarter of the cones on well loaded trees can be seen from one position (pp. 74–5).

[219]. 23.23.12. PRASAD, J. **Some hints for seed collectors.** *Indian For.* 72 (2), 1946 (62–3). [Forest Research Institute, Dehra Dun.]

Great improvement would result in seed collection if adequate payment were made to the forest guard or other person responsible. The selection of suitable mother trees should be an essential part of the routine work of a gazetted officer. Generally, seed should be collected from the trees as soon as natural seed fall commences, but it is very cheap and convenient to collect from felled trees if these are felled when the seed is ripe.

[220]. 23.23.15 : 12.25. Bornebusch, C. H. Opbevaring af Rødgran- og Sitkagranfrø. Foreløbige Forsøgsresultater. **[Storage of Norway and Sitka Spruce seed. Preliminary results of experiments.]** *Dansk Skovforen. Tidsskr.* 29 (7), 1944 (257–63). [Dan.]

A 10-year storage test was begun in winter 1941–42 with specially cleaned seed of the preceding autumn. The present article reports on germination tests in the springs of 1943 and 1944. (*a*) *Seed stored in sealed glass containers* (in a dark frost-free fruit cellar): If initially dried to 8 or 4 per cent. moisture, seed retained its viability unchanged for the 2-year period; seed with an initial moisture of 12 per cent. showed a serious reduction in, and that with a moisture of 16 per cent. a total loss of, viability. Seed subjected before storage to a special light treatment, devised by Carlos Jensen for horticultural seeds, gave results equal to those from the dried seed, but, as this treatment reduced moisture to below 8 per cent., it is not possible to attribute the results to the effects of light as such. (*b*) *Seed stored in paper bags*: With storage in an unheated room or in a cold-storage chamber at + 2° C., viability was reduced in two years from about 80 per cent. to 60 per cent. or lower. Seed in bags hung from the ceiling of a cellar showed only 17 and 5 per cent. viability after two years for Norway and Sitka Spruce respectively.

[221]. 23.23.15 : 12.25. Mirov, N. T. **Viability of Pine seed after prolonged cold storage.** *J. For.* 44 (3), 1946 (193–5).

Recent results of experiments in storage of conifer seeds conducted at the California Forest and Range Experiment Station for many years. The seeds were stored in airtight 5-gallon tins at 40° F., some for as long as 15 years and none for less than 5½ years; the tins were opened occasionally during the storage period, when seed was needed for experiments. For the present test 100 stored seeds each of 19 species of Pine (32 lots) were sown in flats, and stratified at 40° F. for 3 months in order to assure complete germination. Tabulated results compare germination after storage with germination of the same lots made soon after collection.

Pinus monticola, *P. aristata* and *P. balfouriana* all kept well, and it is evident that not all White Pines have perishable seed and that the poor keeping quality of *P. lambertiana* seed is perhaps an exception for the 5-needle group of Pines. The closed-cone Pines (*P. attenuata*, *P. radiata*, and all three varieties of *P. contorta*) have seed of excellent keeping quality, and cold storage is probably not necessary for seeds of this type. *P. ponderosa* cold-stored seed kept better than expected; for under ordinary storage conditions it loses viability fast. Percentages of germination in different lots were 90 after 11 years 5 months, 49 after 8 years 5 months, 56 after 13 years 5 months, 76 after 11 years 5 months, 45 after 5 years 5 months.

As a whole the results confirm the opinion that viability of Pine seed can be preserved for a long time if the seed is kept in airtight containers at a temperature of about 40° F.

[222]. 23.23.15 : 12.26–8. Holten, J. Opbevaring af Askefrø. **[Storage of Ash seed.]** *Dansk Skovforen. Tidsskr.* 30 (2), 1945 (39–40). [Dan.]

Of about 7½ kg. of Ash [*Fraxinus excelsior*] seed, collected in autumn 1939, about 4½ kg. was pit-stored the same autumn and sown in the following spring, eventually yielding some 4,300 2/0 plants per kg. The remainder lay forgotten in a loft for 1½ years, was then pit-stored for 1 year, and sown in spring 1942, yielding about 4,550 2/0 plants per kg. It would thus appear that Ash seed is usable for at least 3 years after collection, though this is contrary to previously accepted opinion.

[223]. 23.23.15 : 12.26–8 : 44.3 : 12.21. Bornebusch, C. H. Meddelelser fra Frøudvalget. Agern og Bog fra Holland og Belgien. Afsvampningsforsøg med Agern. **[Reports from the Seed Committee. Acorns and Beech mast from Holland and Belgium. Experiment on the fungicidal treatment of acorns.]** *Dansk Skovforen. Tidsskr.* 26 (10), 1941 (371–3). [Dan.] Bornebusch, C. H. Fortsatte Forsøg med Afsvampning af Agern. **[Continued experiments on the fungicidal treatment of acorns.]** *Dansk Skovforen. Tidsskr.* 27 (11), 1942 (474–6). [Dan.]

Promising results were obtained in a preliminary test of Tillantin 1875, mixed in a rotating drum with acorns at a rate of 0·3 kg. per 100 kg. acorns, as a fungicide, particularly against *Ciboria*. The results also emphasized the importance of collecting acorns and treating them as early as possible, since infection takes place on the forest floor. In mid-October, 1941, a larger batch of acorns was treated in the same manner, placed for about a month in a loft, then stored (*a*) in moist sand, (*b*) on a cement floor in a cool cellar, and (*c*) in a cold chamber at 2° C. Sowings made in late April, 1942, gave plant per cents. in the following autumn of 38–9 for treated and 14–6 for untreated seed stored by method (*a*), but methods (*b*) and (*c*) gave very poor results, probably owing to excessive drying of the seed.

[224]. 23.23.15 : 12.26-8 : 45.3. Gardner, J. C. M. **Notes on insects in *Prosopis* seeds.** *Indian For.* 72 (2), 1946 (74).

Results of an experiment to determine the efficacy of paradichlorbenzene and of naphthalene in controlling infestation of *Prosopis* seeds by *Pachymerus gonagra* and the effect of each agent on seed germination. Treatment for 2 months with paradichlorbenzene in an air-tight container at 1 g. per 7,000 cu. cm. capacity killed all the insects present; whereas treatment with naphthalene under similar conditions had little or no effect on insect viability. Neither chemical had any appreciable effect on seed germination.

[225]. 23.23.15 : 23.23.19. Johnson, L. P. V. **Effect of chemical treatments on the germination of forest tree seeds.** *For. Chron.* 22 (1), 1946 (17–24). [National Research Council Laboratories, Ottawa.]

Chemical treatments were tested, in comparison with stratification and pre-soaking, for their effects on germination of forest tree seed.

Significant increases in percentage germination were obtained from potassium nitrate in *Betula lenta*, *B. papyrifera*, *Fraxinus excelsior*, *Picea abies*, *P. glauca*, *P. rubens* and *Pinus resinosa*; from thiourea in *Larix decidua*, *Picea abies*, *P. glauca* and *P. rubens*; from ethylene chlorhydrin in *B. lenta*, *B. papyrifera*, *F. excelsior*, *L. decidua* and *Pinus resinosa*; from red copper oxide in *P. resinosa*; from zinc oxide in *B. papyrifera*, *Picea glauca*, *Pinus banksiana* and *P. resinosa*; from stratification in *Acer saccharum*, *B. lenta*, *B. lutea*, *B. papyrifera*, *L. decidua* and *Picea abies*.

The rate of germination was accelerated by potassium nitrate in *B. papyrifera*, *Picea abies*, *P. glauca*, *P. rubens*, and *Pinus strobus*; by thiourea in *B. lenta*, *L. decidua*, *P. glauca* and *P. rubens*; by ethylene chlorhydrin in *L. decidua*; by red copper oxide in *B. papyrifera*; by stratification in practically all species; and by pre-soaking in *L. decidua* and *Picea abies*.

The rate of seedling growth was increased by zinc oxide in *Larix*, *Picea*, *Pinus*, and *Thuja*, and by red copper oxide in *Pinus*.

It is considered that the following species may be treated as indicated with good prospects of beneficial effect:—

Acer saccharum:	stratification 30–40 days.
Betula lenta:	stratification 70 days, 1·4 per cent. potassium nitrate, 1 per cent. ethylene chlorhydrin.
B. lutea:	stratification 50–70 days.
B. papyrifera:	stratification 50 days, 2 per cent. potassium nitrate, pre-soaking, zinc oxide.
B. populifolia:	stratification 50–70 days.
Fraxinus excelsior:	stratification 50 days, 2 per cent. potassium nitrate.
Larix decidua:	stratification 70 days, pre-soaking, 1 per cent. thiourea.
Picea abies:	1 per cent. potassium nitrate, 1·2 per cent. thiourea, pre-soaking.
P. glauca:	stratification 50–70 days, 1 per cent. potassium nitrate, zinc oxide, 1 per cent. thiourea.
P. rubens:	2 per cent. potassium nitrate, 1 per cent. thiourea.
Pinus banksiana:	zinc oxide.
P. resinosa:	stratification 50 days, zinc oxide, red copper oxide.
P. strobus:	stratification 50 days.

23.24. Formation of Stands by Planting

See also *For. Abstr.* 8 (Nos. 83–4).

[226]. 23.24 (68.9). Kelly Edwards, E. J. **The raising and planting of trees on the farm.** *Bull. Minist. Agric. S. Rhod.* No. 1248,

1943. pp. 11 + plate. Repr. from *Rhod. agric. J.* 40 (6), 1943 (394–403).

A reprint of Bulletin 1178 [see *For. Abstr.* 3 (215)] dealing with Eucalypts, Pines, Cypresses, *Callitris*, *Cedrela* and *Jacaranda* in Rhodesia.

[227]. 23.24 (71) : 23.26 : 23.23.1. **Reports of research standing committees, 1945 [Canadian Society of Forest Engineers]: reforestation.** *For. Chron.* 22 (1), 1946 (65–73).

The purpose of this report is to review standard nursery and planting practice in Canada, noting particularly any modifications of technique which may prove beneficial in reducing the cost of stock or increasing its quality and survival. No information was received from Quebec or the Maritime Provinces, so the report is confined to Ontario, the Prairie Provinces and British Columbia.

[228]. 23.24 (73) : 76.1. UNITED STATES. **Forests and employment. Report of the Chief of the Forest Service [1944–]1945.** U.S. Forest Service, Washington, D.C. 1946. pp. iii + 35.

In anticipation of a large post-war programme of reforestation, work was undertaken in 1945 to bring about half of the U.S. Forest Service nurseries back into production at a rate which, by 1947, will provide for the planting of about 150,000 acres of denuded land annually. The Forest Service aims at planting 2¼ million acres of denuded land in the national forests in the next 15 years. In addition, about one million acres of national forest land needs supplemental planting to make it reasonably productive. Planting should be financed in the regular budget so that interrelated operations, extending over a period of about 5 years between seed collection and field planting, may be conducted efficiently. Essential thinning and pruning should also be part of the regular job of national forest administration (p. 12).

[229]. 23.24 (75 : 76) : 21 : 97.1 : 23.23. MINCKLER, L. S. **Tree planting: principles and practices.** *Sth Lumberm.* 171 (2153), 1945 (114–6). [Appalachian Forest Exp. Sta., Asheville, N.C.]

A résumé of results of various experiments in planting in the Appalachian region. Among the subjects dealt with are selection of species for different sites, planting White Pine in Laurel thickets, planting in the Appalachian Spruce type, direct sowing of Pine.

[230]. 23.24 (75.5) : 21. MINCKLER, L. S. **A guide for tree planting in the southwest Virginia counties in the Tennessee Valley.** *Tech. Note Appal. For. Exp. Sta.* No. 61, 1946. pp. 7.

[231]. 23.24 (77.6) : 12.25 : 45.12 : 44.1. CHEYNEY, E. G. **Forest plantations in Northern Minnesota.** *J. For.* 44 (1), 1946 (39–40). [Univ. of Minnesota, St. Paul, Minn.]

A study of coniferous plantations in northern Minnesota showed that they are usually successful in old fields, on recent, severe burns, and on brush-free sandy soils. Deer and rabbits do much damage, but the greatest obstacle to establishment is Hazel brush. Disking and the planting of Balsam Fir are possible remedies, but they are probably too expensive for use by private owners. Balsam Fir is the only species that ever finds its way through a dense stand of Hazel. Very little has been planted, because it has never been considered very valuable, but if it can establish itself in Hazel it might prove a very valuable species.

[232]. 23.24(89). HELGUERA, G., and LOPEZ, E. D. [Editors.] Arboles forestales y ornamentales. **[Forest and ornamental trees.]** Ministerio de Ganaderia y Agricultura, Montevideo. 1945. pp. 31. [Span.]

Practical information on tree plantations in Uruguay, choice of species, selection of the site and utilization of the products, nursery technique, and a list of species suitable for planting in Uruguay with brief notes on their characteristics, soil requirements, propagation, and utilization.

[233]. 23.24 : 11.47.1 : 11.48.3. MCQUILKIN, W. E. **Use of mulch, fertilizer, and large stock in planting clay sites.** *J. For.* 44 (1), 1946 (28–9). [Northeastern Forest Exp. Sta., Philadelphia 7, Pa.]

A small experiment was laid out in 1942 at the Beltsville Experimental Forest to test the effects, with autumn planting, of mulch, fertilizer, and size of stock on a bare, compact, clay soil. Tests were made with large and small grades of 3–0 Red Pine and 1–0 Black Locust. The mulch materials—either Pine litter or broomsedge (*Andropogon* spp.)—were spread about 2 in. deep over an area some 18 in. in diameter round the seedling. The fertilizer was ammonium sulphate, superphosphate and potassium chloride mixed in proportions of 15 : 25 : 4. Forty-six grams of this mixture were applied on the surface of an area of 1 sq. ft. round the seedling after planting.

Of the unmulched trees, 47 per cent. frost-heaved 1 in. or more during the first winter and 20 per cent. of them were heaved completely out of the ground. The corresponding figures for mulched trees were 9 and 0·75 per cent. respectively. Heaving was about twice as prevalent among small stock as among large and among Locust as among Pine. Heaving was more severe among non-fertilized than among fertilized trees: for the unmulched series, fertilized and non-fertilized trees heaved out were respectively 3·5 and 13 per cent. for the Pine, 21 and 42 per cent. for the Locust. Survival was significantly better with Locust than with Pine (84 and 49 per cent.), with large stock than with small (78 and 56 per cent.), and with both kinds of mulch than with no mulch (75 and 51 per cent.). The effects of fertilizer and of kind of mulch were not significant. The fertilizer treatment induced a striking growth response in Black Locust, but was definitely injurious to Red Pine. Growth was not markedly influenced by mulch treatments but the effect of fertilizer on Black Locust was significantly greater with grass mulch than with Pine litter or no mulch. Though, before planting, the site was practically devoid of vegetation, herbaceous weeds developed on the fertilized spots in such luxuriance that some Pine seedlings were completely overtopped. This suggests the possibility of using fertilizer to stimulate weed growth as a means of soil stabilization.

The effect of fertilizer in reducing frost heaving was unexpected and seems not to have been reported previously. Further experiments are in progress on the use of fertilizer with Locust on compact infertile soils. For most sites the optimum economic rate evidently lies between 10 and 50 grams per tree when using complete fertilizers having a total $N-P_2O_5-K_2O$ content of about 20 per cent. In places where only one or perhaps two elements are limiting for tree growth, application of those elements alone might result in considerable saving.

For planting compact, bare clay sites, on which something more than minimum costs can be justified, the following special measures are indicated by the present study: (1) Use of Grade I stock. (2) Use of mulch round the seedlings. This will be beneficial for any season of planting and is practically a necessity for autumn planting in regions where frost heaving occurs. (3) Use of fertilizer on Black Locust.

[234]. 23.24 : 12.25 (489). Bornebusch, C. H. Forsøg med Rødgranplantning efter forskellige Metoder. **[Experiments on planting Norway Spruce by different methods.]** *Dansk Skovforen. Tidsskr.* 26 (3), 1941 (97–107). [Dan.]

In Danish trials established in 1935 and 1936, 2/2 has proved generally superior to 2/0 planting stock, having a lower mortality and retaining its lead in growth. Spade-dug planting pits were best, followed in order by mattocked pits and T-notching with a spade. Some consideration is given to costs and it is concluded (*a*) that 2/0 stock is not to be recommended, being useless on the more difficult sites and on others usually involving beating-up costs that balance or exceed the saving on the stock itself and probably prolonging the rotation by 2 years; (*b*) that the usual practice of planting in dug or mattocked pits is correct, and that mattocked pits give reasonable savings, except on difficult sites, as against dug pits. Experiments have also been started to determine what savings could be effected by the use of wider spacings, the normal being about 1¼ × 1¼ m. [Cf. *For. Abstr.* 8 (No. 208, 241, 655).]

[235]. 23.24 : 12.26–8 (42.1–8) : 21 : 23.5. Rouse, G. D. **Establishment of Oak plantations in East Anglia.** *Forestry* 19, 1945 (56–61). [Forestry Commission.]

Breckland soil types in East Anglia are suitable, but not best, for the raising of an Oak crop. Climatic conditions are severe, frosts in June and September being regular features, whilst frosts in July and August are by no means unknown. Rainfall is low, about 24 in. per annum, and droughts are frequent. In these conditions good crops of Oak can be grown by close planting with an intimate mixture of Scots Pine to act as nurse. Considerable skill is required in the treatment and ultimate removal of these nurses, but the method will probably extend the area over which a valuable timber species can be grown. *Author's summary.*

[236]. 23.24 : 12.26–8 (729.1) : 21. Estado actual de las plantaciones de cedro (*Cedrela mexicana*) en la Isla de Cuba. **[Present state of Cedar (*Cedrela mexicana*) plantations**

in Cuba.] *Carib. For.* 7 (1), 1946 (93–102). [Span.E.f.]

The plantations of *Cedrela mexicana*, which have been made all over Cuba, were studied in order to determine the causes of the failure of artificial regeneration of this species. All pure or unshaded plantations of Cedar were a failure. The most suitable soils are the red clay of the Matanzas and Francisco type and the brown or white clay of the Havana type with a high calcium content. The best plantings were found on soils with a pH above 7. Even more important than soil fertility are drainage and protection from wind in the early years of a plantation. This may be attained by planting on sheltered slopes with a mixture of other species to provide the necessary shade. A not too dense lateral shade seems most favourable. The spacing recommended is not less than 4 m., with alternate rows of other species of trees. Pests and diseases may be controlled in Cuba and are detrimental only on unfavourable sites. Ideal conditions are afforded by fertile, calcareous soil, good drainage, planting with a companion species such as fruit or forest trees providing lateral shade, and protection against strong winds. [Cf. *For. Abstr.* 7 (1167).]

23.24.2. *Methods of Planting*

See also *For. Abstr.* 8 (No. 28).

[237]. 23.24.2 : 07.7. **Improvement in tree planting technique.** *Timberman* 47 (3), 1945–46 (174–6).

An account of a new tool, the Miller tree planter, by which it is claimed that 1,400 seedlings can be planted per day by one man, compared with about 500 per day by hand with a hoe. The seedlings are wrapped in peatmoss and waxed paper which, contrary to some expectations, appears to help in the formation of a healthy root system, possibly because it eliminates air pockets round the seedling roots, which encourage fungus growth. The peatmoss also appears to stimulate the seedling in its first year in a strange soil.

[238]. 23.24.2 : 07.7. ENEROTH, O. Plantering. **[Planting.]** *In* Skogsodling—Föredrag, hållna vid skogsodlingskursen å skogshögskolan den 23–26 april 1945. Svenska Skogsvårdsföreningens Förlag [Stockholm]. 1945. pp. 88–91. [Sw.]

A brief discussion of means of reducing planting costs, excluding cost of planting stock, including a description of a method used in Scania whereby two men and a younger planter can mattock-hoe 50 × 50 cm. patches and plant about 800 2/2 Spruce per 9-hour day on stony, hard soils, or 1,000–1,200 per day (including mattock work) on easier sites. The tools used are a broad mattock for paring the ground cover away and a boring spade. The latter, which is a narrow, very concave spade with a T-shaped grip, is inserted vertically with the concave face towards the workman, twisted to loosen the soil, which is then pulled aside and held with one foot and the spade to leave a planting hole; the planter then inserts the plant and adjusts the roots, and finally the spade is removed and the loose earth firmed with the foot. The results of this method are as good as those of pit planting against a vertical pit wall but naturally not as good as those from the more expensive method of distributing the roots on a small central mound in the planting pit. There is probably no obstacle to the use of this method with younger and smaller planting stock, but in this case a smaller spade should be used. [Cf. *For. Abstr.* 8 (No. 208).]

[239]. 23.24.2 :·07.7. SÖKJER-PETERSEN, E. Några ord om plantering med jordborr. **[Notes on planting with the 'boring spade'.]** *Svenska SkogsvFören. Tidskr.* 42 (4), 1944 (306–9). [Sw.]

Notes to accompany a photograph of the type of mattock and the concave spade used in 'borer planting' [cf. preceding abstract]. Mattocking can be dispensed with on fresh clear-felled areas with no troublesome ground vegetation, thus saving one man's work, though the spade-man then has to decide where to make the planting holes and thus takes rather longer to plant a given amount of stock. Ploughing may replace mattocking if the ground is suitable, and this can mean considerably reduced costs.

[240]. 23.24.2 : 07.7. En amerikansk skogsplanteringsmaskin. **[An American forest planting machine.]** *Skogen* 33 (8), 1946 (138). [Sw.]

Figure and brief description of the Michigan State College Reforestator, a tractor-drawn planting machine capable of planting out 10,000 plants in an 8-hour day, or more under favourable conditions.

23.24.3. *Spacing*

[241]. 23.24.3 : 12.25. Munkøe, J. C. H. Valg af Planteafstand for Naaletræer. **[Choice of spacing for conifers.]** *Dansk Skovforen. Tidsskr.* 29 (8), 1944 (293–318). [Dan.]

A review of literature, mainly German and with chief reference to Norway Spruce, for which it is concluded that rectangular spacings between 1·5 × 1·5 and 2 × 2 m. are economically advantageous and will yield a product of satisfactory quality. Closer spacing would be desirable only under special conditions, e.g. where the sale of Christmas trees or the production of especially fine, clear timber are important; wider spacings might excessively reduce the quality of the timber; spacings with a wider interval between than in the rows are less advantageous than square spacings. For Scots Pine the normal Danish spacing (0·5 × 1 m. or less) appears to be too close, and planting at 1·3 × 1·3 m. is recommended. Recommendations for other species grown in Denmark, from the scanty information available, are:—Sitka, as for Norway Spruce; *Abies*, 1·8 × 1·8 m. (on moist sites and under standards or a nurse crop), but spacings as close as 1 × 1 m. can be used where Christmas trees or decorative branches (*A. nordmanniana*) can be sold; Larch, 2·5 × 2·5 m. or wider, particularly if used as a nurse crop; Douglas, 1·25 × 1·25 m. or closer; Mountain Pine, 1 × 3 m. [Cf. *For. Abstr.* 8 (Nos. 208, 234, 748).]

23.26. Plant Rearing. Nursery Practice

See also *For. Abstr.* 8 (Nos. 64, 82–3, 88–91, 227).

[242]. 23.26. **Baby trees for adoption.** *Timberman* 47 (2), 1945–46 (37–9, 58, 60, 62).

Account of a nursery at Nisqually, Washington, run co-operatively by 7 logging firms. The seedlings (largely Douglas Fir) are intended for planting in burnt-over areas without seed trees. So completely has the whole process been mechanized that one man and 3 women did practically all the work of caring for 10 million seedlings in the summer of 1945. Seed is stratified for 6 weeks and the soil fumigated with tear-gas just before planting. Sowing is done by a drill, the plan of which is described in some detail, the seedlings are weeded by a tractor cultivator, and finally lifted by another tractor-drawn machine. They are sorted on a conveyor belt and packed in sphagnum moss and cellophane. Seedbeds are watered by an overhead sprinkler system. Present output is about 5 million trees per year but several million more could be produced with the same equipment. Tree stock has shown remarkable growth and uniformity in height with vigorous branch and needle growth and equally vigorous root systems. The enterprise has fully carried out the original aim of producing trees for large-scale planting at a minimum cost per unit and per acre.

[243]. 23.26 : 76.1 : 23.24.1 (485). Hedemann-Gade, E. Kostnad för framställning av skogsplantor. **[The cost of producing planting stock.]** *Skogen* 33 (5), 1946 (32–3). [Sw.]

Details are tabulated of the costs per 1,000 usable plants for seedlings and transplants of Pine, Spruce and Birch, based on an investigation in two nurseries of the Stockholm County Forestry Board in 1945. Costs, especially for coniferous stock, are higher than the prices charged by the Board, which is applying for permission to make the necessary price adjustments. It is suggested that it would be advantageous in the long run to raise prices sufficiently to enable better sorting of the stock for sale.

[244]. 23.26 (729.5). Gaztambide, J. B. Semilleros de arboles forestales. **[Forest tree nurseries.]** *Circ. Inform. Serv. Ext. agric. P. Rico* No. 51 (revised), 1945. pp. 3. [Span.]

Practical instructions on the selection of a suitable site, preparation of the ground and of the seedbed, sowing, and transplanting in Puerto Rico.

[245]. 23.26 : 45.3 : 44.3 (73). Cummings, M. B. **Insects and diseases of nursery stock.** *Amer. Nurserym.* 83 (7), 1946 (13–4).

Notes on symptoms and control measures against Spruce gallfly (*Adelges abietis*), Spruce budworm, Spruce sawfly, Cedar-apple rust, Lilac, Birch and Elm leaf-miners (*Gracilaria syringella*, *Fenusa pumila*, *Kaliofenusa ulmi*), black knot of Plums, Pears and Cherries, fire blight of Pears, and Apple cankers.

[246]. 23.26.3. Cummings, M. B. **Tree-lifting device.** *Amer. Nurserym.* 82 (12), 1945 (12).

Description of a simple home-made device used at Vermont Agricultural Experiment

Station for moving trees in winter. The tree-lifter is simply constructed. The base is a plank-drag with rope attached for hauling the trees. An upright frame supports a lever-derrick which makes it possible to lift several hundred pounds of soil along with the roots. By this method, 10-year-old trees can be transplanted without any set-back.

23.27. Arboriculture

See also *For. Abstr* 8 (No. 65).

[247]. 23.27 (73) : 21.0. Wyman, D. **Small shade trees for small properties.** *Amer. Nurserym.* 83 (5), 1946 (7–8, 57–8).

A list, with short descriptive notes, of small shade trees (i.e. trees which do not grow over 20 or 25 ft. high at maturity, or can be maintained at that height with a minimum amount of pruning) suitable for planting in the United States.

[248]. 23.27 (73) : 21.0. Doney, C. F. **Trees for special purposes.** *Brooklyn bot. Gdn. Rec.* (*Plants and Gardens*) 2 (*n.s.*) (1), 1946 (15–26).

An annotated list of trees suitable for planting for ornamental purposes on different sites, e.g. dry and wet soils, seashores, mild climates or very cold climates, all with reference to the United States.

[249]. 23.27 (73) : 21.0. Piester, E. A. **Trees for city streets.** *Brooklyn bot. Gdn. Rec.* (*Plants and Gardens*) 2 (*n.s.*) (1), 1946 (33–6).

Elms, Planes and Maples have been the species most commonly and satisfactorily used for street planting in New England, but they are now threatened by Dutch Elm disease, *Gnomonia veneta* and *Verticillium* wilt respectively, and suggestions are made for alternative species.

[250]. 23.27 (81) : 23.21 : 23.24.3. Silveira de Mello, O. Essências nacionais para a arborização de ruas. **[Native species for street planting.]** *Brasil madeireiro* 1 (5), 1945 (6–7). [Port.]

Advice on spacing, arrangement, and choice of species. Native Brazilian species suitable for street planting include *Holocalyx glaziovii*, *Cassia grandis*, *Caesalpinia peltophoroides*, *C. ferrea*, *C. echinata*, *Tipuana speciosa*, *Centrolobium tomentosum*, *Jacaranda cuspidifolia*, *Erythroxylon pulchrum*, *Felicium decipiens*, *Tecoma heptaphylla*, *T. odontodiscus*, *Vochysia oppugnata*, *Hortia arborea* and *Sapindus saponaria*.

[251]. 23.27 (81) : 23.21. Filho, J. M. A arborização das estradas de rodagem. **[The planting of trees along highways.]** *Brasil madeireiro* 1 (6), 1945 (4–5). [Port.]

The author emphasizes the value of roadside trees, particularly in the tropics, and lists the main principles to be followed in the choice of species, and in the planting and care of roadside trees. Preference should be given to quick-growing indigenous species which occur locally, with exotics as second choice.

[252]. 23.27 (82) : 21.0. Capello, A. Especies adecuadas para el arbolado de calles y carreteras. **[Species suitable for streets and highways.]** *Alm. Minist. Agric. Argentina* 19, 1944 (129–31). [Span.] A.P.B.

The species most commonly used in Argentina for roadside planting are Plane and Maple. Among the indigenous species suggested for roading planting are Jacarandá [*Jacaranda* sp.], Ibará-Pitá [?*Peltaphorum*], Timbô [*Enterolobium timbouva*] and Lapacho [*Tabebuia* sp.]. Suitable exotic species whose timber is of commercial value are Ash, *Catalpa Liriodendron*, *Sophora*, Oak and Bald Cypress.

23.3. Afforestation

[253]. 23.3 (41.1–4) : 11.49.5 : 23.24 : 11.47.1. MacDonald, J. A. B. **The Lon Mor: twenty years' research into wasteland peat afforestation in Scotland.** *Forestry* 19, 1945 (67–73 + plates).

A review of 20 years' work by the Research Branch of the Forestry Commission on a stretch of Highland peat bog. Planting on inverted, thin turfs by the side-notch method was found to be the most satisfactory system. The difficulty of cutting thin (5 in.) turfs by hand has now been obviated by the use of a caterpillar tractor and a Massey-Harris Prairie Buster plough. *Picea omorika* has done better than any other Spruce and only difficulty in obtaining planting stock in quantity has prevented its more general use. Scots Pine and *Pinus contorta* do well, except for blackgame damage. *P. montana*, though slow to establish itself, eventually covers the ground better than the other two Pines. *P. radiata* unexpectedly continued to grow on bad peat and in full exposure. European Larch did badly, *Larix dahurica* died out, but hybrid and Japanese

Larches did well if given phosphate dressings and closely spaced. Douglas, Noble, and Silver Firs were moderately successful. Among the failures were *Thuja*, Lawson's Cypress and *Cryptomeria japonica* and practically every hardwood except Grey Alder.

Numerous experiments have been made in manuring. Ground mineral phosphates (basic slag), at a rate of 1½ oz. per plant as initial dressing, seems to be the best way of administering phosphates. The indications are that complete manures will not prove so much better than phosphates as to be worth using. It is clear that phosphate in some form is essential to conifer growth on poor peat soils. [Cf. *For. Abstr.* 8 (No. 211).]

[254]. 23.3 (46). SANTOS CARRAL, J. El arbol en la colonización. **[The tree in colonization.]** *Agricultura, Madrid (Supl. Colon.)* No. 2, 1944 (68–72). [Span.] A.P.B.

Planting has already begun at the rate of about 400 hectares annually in the zone of the Aragón and Cataluña Canal, Spain, and nurseries are being established to supply the needs of reafforestation in this and in other areas.

[255]. 23.3 (489) : 11.49.5 : 12.19 : 21.0. THOMSEN, E. Trædyrkning paa Mosejord. **[Tree-growing on peat soils.]** *Dansk Skovforen. Tidsskr.* 29 (4), 1944 (133–59). [Dan.]

Stress is laid on the need for distinguishing between the various types of peatland, viz.: (i) raised (*Sphagnum*) bogs, which occupy a comparatively small area in Denmark and are probably not worth afforesting; (ii) transitional bogs (intermediate between bog and fen), on which it may be worth while to grow Birch, Norway Spruce and Scots Pine in places where trees of tolerable growth and form are already present; (iii) peatlands of a fen type (richer in plant nutrients than the preceding, especially in Ca, but having relatively low P and K contents compared with ordinary soils), which are classified as (*a*) grass fens or peat meadows, (*b*) *Paludella* or spring fens, and (*c*) scrub-and-wooded fens [corresponding roughly to the English carr]. The last-named are considered in some detail as the most promising for conversion to forest, and are further subdivided into a Birch type (poorer in nutrients, with groundwater often more or less stagnant; associated species Spruce, Scots Pine, Willows, Aspen, Juniper, *Vaccinium* spp., Heather, and grasses) and an Alder type (richer; with moving groundwater; associated species Ash, Elm, Rowan, Hazel, Breaking Buckthorn and a varied herbaceous vegetation).

Of the possible species for such sites, Alder and Ash require moving groundwater and peat shallow enough to enable their roots to reach the mineral soil, if they are to do well. Poplars are also a possible choice for similar conditions, though as yet insufficiently tried. Birch, especially *B. pubescens*, grows satisfactorily on a wide range of peat sites and is valuable as a soil improver and as a shelterwood for young conifers. Norway Spruce, to which much attention is devoted, is also suited to a wide range of peat sites, where, on a rather lower rotation, it gives yields not a great deal below those on non-peaty sites of medium quality. Notes are included on drainage, which will probably be necessary. Natural regeneration can be used if sufficient advance growth of good quality exists, otherwise plantings must be made, with relatively large stock and, if *Molinia* is present, preferably with a covering of brushwood between the rows. Existing Birch or Alder can be used as a shelterwood to minimize the risk of frost damage. Experience with Sitka Spruce on these sites is limited but this species probably needs somewhat better sites, and is probably more sensitive to stagnant groundwater and to frost than is Norway Spruce.

The spring fens occur chiefly in broad valleys in Jutland, at the junction of permeable with impermeable strata near the foot of slopes. The peat, consisting largely of *Paludella squarrosa*, is richer in nutrients than other fen types and bears a varied vegetation of mosses, sedges and herbs, often with Willows, Alder and Birch. Where (as in most places) the groundwater is calcareous, it will probably pay to improve the drainage and plant with Alder. [Cf. *For. Abstr* 8 (No. 645).]

[256]. 23.3 (54) : 21.0 : 34. BADHWAR, R. L., and GRIFFITH, A. L. **Suitable species for dry and desert areas.** *Indian For.* 72 (2), 1946 (64–73). [Forest Research Institute, Dehra Dun.] 6th Silvicultural Conference, Dehra Dun (1945).

A list of woody and herbaceous plants, indigenous and exotic, which may possibly prove useful in the afforestation of dry areas in India. The habit of each species is noted, and some indication is given of its possible use as a sand-binder, its suitability for growth in arid areas, irrigated plantations and canal plantations, and its probable importance commercially. [Cf. *For. Abstr.* 8 (Nos. 72, 755).]

[257]. 23.3 (54.7) : 23.22.2 : 21.0 : 38.63. PETTY, J. **The afforestation of dry areas in Sind.** *Indian For.* 72 (2), 1946 (61–2). 6th Silvicultural Conference, Dehra Dun (1945).

Prosopis glandulosa was introduced near Hyderabad (Sind) late in the last century for the fixation of shifting sands. It has proved fairly successful but has not spread extensively except within a 15-mile radius of Hyderabad. Methods of raising irrigated plantations in Sind given in Howard's 'Note on a tour of inspection of the Sind forests' [cf. *For. Abstr.* 6, 1945 (267)] are reproduced. In addition to *Acacia arabica*, Mulberry and *Prosopis spicigera* are useful. The suitability of certain exotics, such as *Acacia mollissima*, *A. decurrens*, and Cricket-Bat Willow, for growth under Sind conditions is one of several subjects requiring investigation.

[258]. 23.3 (75 : 76) : 21.0 : 23.22. MINCKLER, L. S. **Third-year results of experiments in reforestation of cutover and burned Spruce lands in the southern Appalachians.** *Tech. Note Appal. For. Exp. Sta.* No. 60, 1944. pp. 10.

For previous report see *For. Abstr.* 3 (129). This second report makes the following general recommendations:—

(1) Typical Spruce sites, characterized by relatively shallow organic soils, a tendency towards podzolization, moist to wet conditions, and a moderate to heavy vegetative cover, should be planted to Red Spruce. Red Pine should be planted only on drier, more exposed sites, with a relatively deep mineral soil and sparse to moderate vegetation.

(2) Sites with dense herbaceous and shrubby vegetation and young stands of undesirable hardwoods, should not be planted unless some provision is made for release. Release work should be done in late June or early July; this is important for maximum benefit to planted trees and minimum sprouting. Sites with blackberry, fern, or similar species as the predominating cover are plantable without release if the density is 0·75 or less.

(3) Planting sites with extreme conditions of heavy cover will probably require super stock plus release, or regular stock plus frequent and heavy release. Super stock without release should give success on borderline sites (0·8–0·9 density).

(4) Severe rocky sites with thin soils and very sparse vegetation can be successfully planted or seeded in the soil pockets. The limitations of the soil will greatly restrict the value of the stand, but the object would be the production of seed-bearing trees rather than timber.

(5) A combination of burning and grazing followed by planting is probably the cheapest and most effective treatment for establishing Spruce on heavily vegetated sites. This method should be tested experimentally.

(6) Many of the cut-over and burned Spruce-type lands are unfitted by soil and climate for the growth of any timber species except Red Spruce, Southern Balsam Fir and Red Pine. Although complete planting may not be possible or desirable, the establishment of strategically situated blocks of seed plantations will greatly accelerate the attainment of a timber cover.

[259]. 23.3 (75 : 76) : 97.1. WAKELEY, P. C. **How much forest planting have we to do?** *Sth. Lumberm.* 171 (2153), 1945 (163–7). [Southern Forest Exp. Sta.]

The writer analyses the data provided by the U.S. Forest surveys and concludes there are, in the Southern Pine region, a little more than 13 million acres of land which it is physically possible and silviculturally desirable to plant. It has been established that the clear-cut lands are largely incapable of re-stocking by natural means within 2 pulpwood rotations, and that partly cut lands in all types are grossly understocked. In many partly cut Loblolly/Shortleaf Pine stands the ground is being usurped by low-grade or useless hardwoods. Planting is the only way of restoring commercial forests in these cases.

[260]. 23.3 (77.2) : 21.0. SAWYER, L. E. **Indiana strip-mine plantings.** *J. For.* 44 (1), 1946 (19–21).

Reforestation of the spoil mounds following open-cast coal mining in Indiana has been under way since 1926. Many species, both softwoods and hardwoods, have been tried. For several years Black Locust [*Robinia pseudoacacia*] was regarded as the best tree to plant. It has, in fact, improved the sites and some natural reproduction of hardwoods is coming in and making good growth; but most of the Locust itself is so riddled with borers that few of the trees will reach merchantable size. American Larch and several species of Pine show excellent growth. Jack, Red, White, and Scots Pine are oustandingly successful, and Jack and Scots Pine planted as late as 1934 and 1926 respectively are already surrounded by seedlings 3 or 4 years old.

Earlier work was carried out independently by the different companies, but the Indiana Coal Producers Association is now making plans for land use and development for the whole area. This plan includes classification of the stripped lands for either forestry or grazing, and of the unstripped areas for crops, forest or grazing. The use of all land is to be based on soil tests. Spoil-mound areas where the pH is above 6·0 have been found to be well adapted to the production of forage crops. Adjacent areas of unstripped land, too small to be used economically for cultivated crops, are to be limed, fertilized, and sown with the stripped areas and included in the pasture units. The reforestation of all mined-out land having a pH of 4·0 or above and of adjacent unmined areas, is to proceed as rapidly as the supply of planting stock and labour will permit.

[261]. 23.3 (77.5) : 06.6. Taylor, M. N. **Trees for tomorrow.** *Paper Ind.* 27 (12), 1946 (1806–9). P.R.

An account of the work of Trees for Tomorrow Inc., an organization set up by various Wisconsin paper mills with the object of encouraging reforestation in Wisconsin. The organization has created forest scholarships, sponsored the creation of a reforestation institute and the creation of school and memorial forests. It has also encouraged planting by farmers, loggers and timber-tract owners by offers of free seedlings etc. Brief summaries of the reforestation work of the paper mills themselves are also given.

[262]. 23.3 (81) : 23.21 : 11.47.6. [Tatto, L.] Florestamento em terrenos pobres e descampados. **[Afforestation on poor and barren soils.]** *Rev. flor., Rio de J.* 3 (1), 1943 (70–2). [Port.]

Species recommended for afforesting dry areas in Minas Gerais, Brazil, are Jacaré (*Piptadenia communis*), Eucalypts (*Eucalyptus saligna* and *E. alba*), Cedro Rosa [*Cedrela odorata*?], Garapa [*Apuleia praecox*?] and Cabiuna [*Dalbergia nigra*?].

[263]. 23.3 (91.4) : 96 : 11.47. Dacanay, P. **Progress of reforestation in the Philippines.** *Rev. int. Prod. colon.* No. 196–7, 1946 (10–15). [E.]

An account is given of forest legislation in the Philippines, and of the various reforestation projects undertaken by the Bureau of Forestry either for conservation purposes or to provide firewood, etc. After much experiment, it has been found that the following important species can be used successfully for reforestation and as plantation crops: Ipil-ipil [?*Leucaena glauca*], Lumbang [?*Tarrietia javanica*], Baguilumbang, Acacia, Molave [*Vitex parviflora*], Lanutan, Narra [*Pterocarpus indicus*], Teak [*Tectona grandis*], Big-leaf Mahogany and Small-leaf Mahogany [?*Dipterocarpus* spp.], Taluto, Malaruhat, Benguet Pine, and *Cedrela odorata.*

Waste land may be made productive by planting Ipil-ipil, which is in great demand as firewood besides its use as a soil improver; the best financial rotation for this species is 5 years. The amount of nitrogen in 2-year-old plants of this species was found to average 1·12 per cent. of their dry weight, and the soil under a stand 18 months old contained 0·01 to 0·015 per cent. more nitrogen than the soil on adjacent waste lands.

23.5. *Underplanting. Shelterwoods. Nurses*

[264]. 23.52 : 12.26–8. Thorold, C. A. **Observations on a trial of trees as shade for cacao.** *Trop. Agric., Trin.* 22 (11), 1945 (203–6).

Two species of *Erythrina*, *E. poeppigiana* (Anauca Immortelle) and *E. glauca* (Bocare Immortelle) are commonly used as shade trees in Trinidad cacao plantations, but are apt to suffer from a fungus disease associated with *Calostilbe striispora.* An experiment is described comparing the growth data of 15 tree species on land infested with the fungus. It is concluded that *Peltophorum ferrugineum* is worth further trial as a shade tree to be substituted for Bocare Immortelle where a moderately high canopy is required. For high shade canopy, *Schizolobium excelsum* and *Parkia roxburghii* might be suitable where land tends to be waterlogged. Descriptive notes are given on the 15 species included in this trial. *From author's summary.*

23.6. *Fencing. Hedges. Care of Regeneration in the Initial Stage of Establishment*

[265]. 23.6. H[au]b[er]g, P. Elektrisk Hegn omkring Kulturarealer. **[Electric fence round plantation areas.]** *Dansk Skovforen. Tidsskr.* 30 (1), 1945 (8). [Dan.]

In the trial described, at Hachenburg in Germany, an electric fence, non-dangerous to man or animals, proved effective against roedeer and is presumably so against other large mammals, but not against hares and rabbits. Norway Spruce posts 10 cm. in diameter, 1·3 m. long, and spaced 8 m. apart, were used with oval (1·8 × 2·2 mm.) barbed wire, the lower wire being 45 cm. and the upper 80 cm. above ground level. Current [voltage not stated] was supplied by dry batteries. Costs were 0·50 RM per running metre, as against double that amount for the usual type of wire-netting fence.

[266]. 23.6 (729.1). Crane, J. C. **Living fence posts in Cuba.** *Agric. in Americas* 5 (2), 1945 (34–5, 38). A.P.B.

Because of the scarcity of stones in some parts of Cuba and the rapidity with which cut wood decays or is attacked by termites, thick-growing and barbed plants are used as living fences. They include: *Gliricidia sepium* (an exotic which ranks first in importance and is used all over the island), *Erythrina berteroana*, *Spondias mombin* (recently decreasing in importance, because its fruit, when eaten by cattle, taints the milk and impairs its keeping qualities), *Bursera simaruba*, and *Bromelia pinguin*. Of the 20 or more species of plants used at present, only two (*Moringa pterygosperma* and *Anacardium occidentale*) produce a potentially commercial product.

[267]. 23.61 : 24.1 : 07.7. Taylor, W. L. **Weeding and cleaning.** *Forestry* 19, 1945 (27–32).

General notes on weeding and cleaning in plantations in Great Britain. It is urged that weeding gangs should be directed daily to the areas most in need of attention, instead of working straight through a plantation without regard to day-to-day conditions. Tools recommended are a short-handled bagging or reaping hook for weeding and a bill hook for cleaning, but unless workers are highly skilled it is advisable to use the hand saw for brashing side branches.

24. TENDING OF STANDS AND TREES

[268]. 24 (485) : 33.7 : 66 : 97.3. Bundy, O. Vedhuggningarna och skogsvården. **[The fuelwood fellings and silviculture.]** *Svenska SkogsvFören. Tidskr.* 42 (1), 1944 (24–33). [Sw.]

A discussion of, and recommendations on the means of finding the fuelwood necessary to meet, the war-time shortage of fuel in Sweden, and at the same time turning such fellings to good account silviculturally, e.g. by improvement thinnings, and by regulation of grazing so that the worse types of wooded pasture and low-quality forest might be cut and given over entirely to pasture while the better areas could be closed to grazing. A plea is made that the County Forestry Boards should be given legal power to direct the management of neglected land in private ownership.

[269]. 24 : 12.26–8 : 23.61 (75). Downs, A. A. **Response to release of Sugar Maple, White Oak, and Yellow Poplar.** *J. For.* 44 (1), 1946 (22–7). [Appalachian Forest Exp. Sta., Asheville, N.C.]

The early data from the weeding studies dealt with in this article were analysed by crown class only [see *For. Abstr.* 4 (228)]. The additional 3 years' data now available permit an analysis of response to release based on diameter and height growth by both crown class and vigour class. Release tended to stimulate diameter growth in all crown classes and height growth in the lower crown classes when vigour was not poor. Sugar Maple responded most and Yellow Poplar least. Response was greater for diameter growth than for height growth, tended to be greater for heavy release than for light release, and, within a crown class, increased with better vigour. Weeding is recommended for trees of good and medium vigour but not for those of poor vigour. Recommendations for weeding are tabulated, using crown class and vigour of desired crop trees as criteria to determine which trees will respond favourably to release. Sugar Maple responds so well to release that thinning in sapling stands, even before the trees are large enough to pay for the operation, is recommended. Thinning from above is practicable in Sugar Maple and White Oak, because codominant and intermediate trees of medium vigour respond well to release.

24.2. *Thinnings*

[270]. 24.21 : 12.25 : 76 (489). Neergaard-Petersen, C. Tyndingshugstens Økonomi ved Rødgrandyrkning i Danmark. **[The economics of thinning in Norway Spruce cultivation in Denmark.]** *Dansk Skovforen. Tidsskr.* 25 (8), 1940 (446–7). [Dan.]

Grøn's claim [see *For. Abstr.* 5 (254)] that moderately heavy thinnings give the best financial yields is questioned on the grounds that when a suitable market exists for the products, light thinnings producing a different range of products (by size classes) might conceivably be equally profitable. Further study of this question is needed.

[271]. 24.21 : 12.25 : 76 : 63 (489). Bornebusch, C. H. Udhugningsgrad, Omdrift og Økonomi. **[Thinning grade, rotation and economics.]** *Dansk Skovforen. Tidsskr.* 25 (9), 1940 (481–5). [Dan.]

Bornebusch questions Grøn's use of the same rotation in comparing different thinning grades for Norway Spruce [see *For. Abstr.* 5 (254)] and emphasizes that his own doubts about heavy thinnings arise from the rapid attainment of large dimensions by trees in stands so treated, which (i) implies poorer natural pruning and shorter, stouter form, (ii) makes a shorter rotation appear attractive, and (iii) probably gives less volume increment at the higher ages.

24.3. *Opening of the Canopy. Release and Improvement Fellings (including Poisoning and Girdling)*

See also *For. Abstr.* 8 (No. 705).

[272]. 24.3 : 57 : 12.26–8 (74.). Hough, A. F., and Taylor, R. F. **Response of Allegheny northern hardwoods to partial cutting.** *J. For.* 44 (1), 1946 (30–8). [North-eastern Forest Exp. Sta., Philadelphia, Pa.]

The 10 years' experimental data from sample plots in north-western Pennsylvania presented in this paper provide new and detailed information on the response of a 40-year-old stand to partial cutting. The stand from which 38 per cent. of the basal area was cut in 1933 grew 1·73 cords per acre per year during the next 10 years, while the uncut control stand grew only 1·02 cords per acre per year. Glaze storm damage, which appeared to be very serious in 1936, was more apparent than real. Partial cutting lowers the mortality rate of most species. Sugar Maple and Beech under 8 in. d.b.h. show the greatest decrease in mortality; these species stand suppression well and grow fast after release. A method of predicting the stand 10 years hence by means of species-diameter curves of mortality and growth is suggested. *From authors' summary.*

[273]. 24.31 : 12.26–8. Wielandt, T. S. Ringning af Overstandere. **[Girdling of [Beech] standards.]** *Dansk Skovforen. Tidsskr.* 27 (10), 1942 (444–7). [Dan.]

In the method described of girdling Beech standards over regeneration, the bark is removed in a strip about 10 cm. wide all round the trunk at a height of 50–60 cm. above ground. For this purpose a special type of scribe (for making the horizontal cuts) and a special barking iron (both tools figured) are used, both bark and cambium being removed. One man can girdle 5–6 old Beeches per hour. The trees live for 1–5 years after girdling and are removed preferably before they die, as otherwise the dead wood becomes dry and hard to cut. The wood of girdled trees is lighter and thus easier to haul than is normal wood, and shows some deterioration below the point of girdling.

[274]. 24.31 : 12.26–8. Pessin, L. J. **Recommendations for killing scrub Oaks and other undesirable trees.** *Occ. Pap. Sth. For. Exp. Sta.* No. 102, 1942. pp. 5.

Methods of killing Scrub Oaks were tested in southern Mississippi: (1) Most of the trees that were cut either above or below ground level produced vigorous sprouts. (2) Girdling or removing strips of bark at the base, up to 1 ft. above ground yielded fairly satisfactory results. Although the crowns died slowly, no sprouts developed from either the root collar or the stem. This method, although costly and requiring very careful work, is recommended where it is unsafe to use poison. (3) Burning the butts of the trees with a blow-lamp was ineffective. (4) The most successful and cheapest method was injecting sodium arsenite into the roots or stems of trees with a special tool. Most of the trees so treated died in a relatively short time. [Cf. *For. Abstr.* 8 (No. 558).]

24.4. *Shelterbelts. Windbreaks*

[275]. 24.4 (76 : 78). Munns, E. N., and Stoeckeler, J. H. **How are the Great Plains shelterbelts?** *J. For.* 44 (4), 1946 (237–57). [Lake States Forest Exp. Sta., St. Paul, Minn.]

The Prairie States Forestry Project was in operation from 1934 to 1943. During that period, nearly 19,000 miles of shelterbelts were planted on about 33,000 farms. A survey of the plantings, made in 1944, covered 1,079 belts or a random sample of 3·6 per cent. of all belts planted. The project was a sucess in meeting the main purpose for which the belts were established, that of protection against the wind. For the area as a whole, 78·4 per cent. of the belts were rated as good or better, and only 10·4 per cent. as unsatisfactory. Tree survival was generally good, ranging from 39·2 per cent. for Ponderosa Pine, the poorest, to 85·0 per cent. for Boxelder (*Acer negundo*), the best.

There was a direct relation between quality of belts, based on survival and growth, and the annual precipitation and quality of sites. Growth rate in the areas of better rainfall was 30–50 per cent. greater than in the more arid areas. The best planting sites were generally the deep sandy loam or loamy sand soils with deep moisture penetration. There was a striking differential in survival and growth rate in favour of sandy as opposed to heavy soil for many species.

The most striking feature of the belts is their rapid height growth. They average about 7 years in age, and in North Dakota are 16 ft. high, in Nebraska 20 ft., and in Texas 24 ft. In the southern Great Plains a number of belts 7–10 years old are 25–40 ft. high and are already very effective in reducing wind erosion. Annual growth rate is 2·9 ft. for Cottonwood (*Populus* sp.), 2·3 ft. for Siberian Elm (*Ulmus pumila*) and Black Locust (*Robinia pseudoacacia*), and about 1·3 ft. for slower growing hardwoods such as Green Ash (*Fraxinus pennsylvanica*). Conifers such as Ponderosa Pine and Red Cedar (*Juniperus virginiana*) are making from 0·6 to 0·9 ft. per year. Shrubs are growing at an average rate of 1·1 ft. per year.

Most of the belts from 5 to 10 years old have complete stand closure in that part of the belt where the species are fast growing. A forest condition, with leaf mulch ½–1 in. deep, is developing in these rows.

The chief problems are inadequate cultivation of many of the belts under 4 years of age (owing to shortage of labour) and cattle damage to 8·1 per cent. of all belts. Great need is now developing for silvicultural treatments but no information is available on how to proceed without reducing the effectiveness of the belts. Research is needed on this and on management and replacement, development of hardier strains of planting stock, planting on more difficult soils and sites, and the formation of belts for special services. [Cf. *For Abstr.* 7 (Nos. 224–6, 754, 1192.] *From authors' summary.*

24.5. *Pruning*

See also *For. Abstr.* 8 (No. 725).

[276]. 24.5 : 12.25 : 21.6. Bickerstaff, A. **Knot-free Red Pine by debudding: project P-38.** *Silvic. Res. Note Dom. For. Serv.* No. 76, 1945, pp. 10 + charts.

Experiments on Pine (mainly *Pinus resinosa* [similar to those carried out by Krotkevich, at Kiev Forestry Research Institute, see *For. Abstr.* 2 (106)]), were begun in 1940 at the Petawawa Forest Experiment Station, to find out the effect of debudding upon the growth, form and silvical behaviour of the tree and on the quality of wood produced. The Russian experiments indicated the possibility of producing completely clear Pine logs by removing annually all the lateral buds on the terminal shoot as soon as the tree is a few feet high, with the object of producing a tree with whorls of branches on the lower part of the stem, a completely branch-free section extending upwards for about 18 ft., and a normally developed crown. Results of the Petawawa experiments are very encouraging for Red Pine, fair for White Pine (*Pinus strobus*) but poor for White Spruce (*Picea glauca*). Diameter growth increased in the upper part of the tree, but tended to be less in the lower part. Height growth was not appreciably affected. Some of the heavy basal branches were partially pulled from their sockets by the weight of snow in winter and it has yet to be seen whether the trees will stand up to wind or sleet after the first whorl of new branches has developed. The cost of debudding compares favourably with that of orthodox methods of pruning.

WOOD-WASTE UTILIZATION*

I. THE CHEMICAL UTILIZATION OF WOOD-WASTE

By W. G. Campbell, B.Sc., M.S., A.R.I.C.
Forest Products Research Laboratory, Department of Scientific and Industrial Research

The efficient utilization of otherwise unusable wood waste by some kind of chemical conversion represents an ideal which has so far proved impossible of attainment except under special circumstances. The obstacles in the path of the chemist in these days are constituted, not so much by lack of knowledge of what wood can be made to yield in the way of useful products, but rather by human and economic factors which are beyond his control. To be successful, commercial chemical operations must be carried out on an adequate scale in an efficient plant, which is well located in relation to power and transport facilities as well as to continuous supplies of uniform raw material and chemicals. In practice this means, either that plant and chemicals must be taken to the source of the raw material, or that both raw material and chemicals must be transported to centrally located plant. Herein lie the main economic factors to be considered in the chemical utilization of wood, and the position is further complicated by the fact that many of the products which can be obtained from wood by chemical processes are more readily obtainable at lower cost from other sources. It is therefore not possible to propound a scheme for the chemical utilization of wood waste which will be of universal application in all circumstances. The purpose of the present article is briefly to review the major chemical processes that can or might be applied to wood waste in order to yield utilizable products and, wherever possible, to cast some light on the general economics of the undertaking.

As a chemical raw material, wood waste may be considered in three categories as follows:—(1) Branch and stump wood suitable for distillation, (2) slabs and offcuts suitable for conversion to pulping chips, and (3) sawdust shavings and planer chippings.

(1) Branch and Stump Wood.

Destructive distillation was by far the earliest chemical conversion process to be applied to wood. In its crudest form it is applied to the production of charcoal in the primitive pit kiln. Charcoal production by this method can only be of economic importance when constant composition and properties in the product are not prime considerations, and this method is therefore applicable to the waste of any species. By the early part of the present century, however, wood distillation had become a highly specialized industry, softwoods being worked for charcoal, tar, and pitch, and hardwoods for charcoal and the valuable volatile products acetic acid, methanol or wood spirit, and acetone. Softwood waste, rich in oleoresin, has, in addition, been worked for turpentine by steam distillation and for rosin by solvent extraction [1].

The hardwood distillation industry was at one time the sole source of methanol, but the advent of synthetic processes for the manufacture of this important chemical dealt the industry a blow from which it is hardly likely to make a permanent recovery.

The economic success of wood distillation depends largely upon suitable markets for the charcoal which is in major product. This explains why, when a demand for special types of charcoal arises, as it did in Great Britain during the recent war, kilns are frequently designed for making the required charcoal and no provision is made for collection of the volatile products.

(2) Slabs and Offcuts.

Theoretically any form of waste wood which can be converted by hogging into suitable chips is potential raw material for pulp and paper manufacture, but it should be borne in mind that in this highly organized industry, raw material of the best quality offers the best financial returns and, in normal times, as has been shown in a Canadian survey [2], many difficulties would have to be overcome before some forms of mill and factory waste, which have been shown to be technically suitable for pulping, could be collected and incorporated as part of the raw material delivered to the pulp mills. Laying aside for the present these difficulties, which have been ascribed [2] to a 'lack of organized marketing and concerted action far more than to any purely technical difficulties', we may with profit examine very briefly certain modern trends in the chemical utilization of those forms of wood which are capable of conversion to pulping chips.

---

* This paper is communicated by permission of the Department of Scientific and Industrial Research. It is a revision of the articles by these authors originally published in *Forestry Abstracts*, Vol. 4, No. 2, 1942.

The object of all pulping operations is to break wood down into its ultimate fibres so that these latter may be reconstituted into sheets and boards and thereby enter the channels of utilization which are universally familiar. The cell-wall substance of wood consists of the three major components—cellulose, hemicellulose and lignin, and in established chemical pulping processes such as the sulphite, soda and sulphate processes, the principal end product is cellulose, so that the lignin and much of the hemicellulose become waste products, which themselves present exceedingly complicated utilization problems. In addition to lignin, the waste liquors from commercial pulping operations such as, for example, the sulphite process, contain hexose and pentose sugars. The hexoses can be fermented with yeast to yield a high grade of industrial ethyl alcohol and this process is operable on a large scale [3]. After the addition of a source of nitrogen and phosphorus, sulphite waste liquor can be used as a culture medium for the so-called fodder yeast, *Torula utilis*, and other species, which can utilize both hexoses and pentoses. Considerable quantities of fodder yeast were produced in Germany during the recent war and used for both human and animal food. The yeast is claimed to contain some 50 per cent. of digestible protein and to be rich in vitamins. The economics of the production of fodder yeast from pulp waste liquors are still somewhat uncertain but, as will be seen in a subsequent section, wood can be treated in other ways to yield the same end-product and preliminary economic data are available.

The lignin present in pulp waste liquors is currently being used on a commercial scale for a wide variety of purposes such as tanning agents, dispersing agents in the synthetic rubber and cement industries and in the treatment of boiler feed water. It is used in ceramics to some extent and also in the preparation of moulding sands. Lignin also finds application as an 'expander' in electrical storage batteries. The lignin from sulphite waste liquor is used commercially as a source of vanillin for flavouring purposes and several forms of lignin find application in the plastics field. Despite this wide range of uses, however, the time is not yet in sight when a profitable outlet will exist for all of the lignin likely to become available from current and prospective processes in which wood is the raw material.

In a recent review, Potter [4] has emphasized that, in the future, more and more wood cellulose will be used for purposes other than paper, such as the manufacture of viscose rayon and cellophane, to name only two examples, so that research on the most efficient methods of producing high-grade cellulose from wood can confidently be expected to continue. There are, however, other chemical and semi-chemical methods of pulping wood chips in which cellulose, as such, is not necessarily the primary end product. A few processes of this type will be referred to because they exemplify the most modern and efficient way to ensure almost complete chemical utilization of wood.

The Masonite Process.

The product known as 'Masonite' was invented in 1924 by William H. Mason at Laurel, Miss., U.S.A. The wood fibres of which it is composed are produced by a unique explosion process which can be controlled to produce pulp for some six different types of board. Research by the Masonite Corporation, which is described in an interesting article by J. A. Lee [5], indicates that the liquid effluent obtained in the production of Masonite is a valuable source of chemicals. Some 70 per cent. of the solids in this effluent are convertible to the sugars glucose, galactose, mannose, xylose and arabinose, and from the remaining 30 per cent., tars, fatty acids, waxes and resins can be derived. Methods have also been developed for the recovery of furfural, acetic and formic acids from the volatile by-products of the process, and it was proposed in 1939 to erect a large plant to embody these various recovery processes in the complete Masonite process. Such is the scale upon which this process is operated, that one mill produces 400,000,000 sq. ft. of board in a year and the potential output of sugars alone from its effluent amounts to 150,000 lb. per day. The total capacity of the five Masonite plants located in different parts of the world was stated in 1939 to be 582,500,000 sq. ft. of board.

The Asplund Defibrating Process.

This process was invented in 1932 by Arne Asplund, a Swedish engineer. It is carried out on various lignocellulose raw materials, including wood, and is based upon the discovery that, when heated to 160° to 180° C. in the presence of moisture, wood chips are softened and can be ground at these high temperatures to produce a highly defibrated product at a low power consumption. Yields of pulp of 92 to 96 per cent. of the dry weight of the original material have been claimed for this process, which is well described in an article by Lowgren [6]. There is no doubt that in the Asplund process there exists one of the most efficient commercial methods for utilizing wood. In the article just quoted it is stated that about 60 per cent. of the 120,000 metric tons of wallboard produced in Sweden in 1939 was made from Asplund pulp, and that in the United States 100,000 tons are now used annually in the roofing-flooring industry. It is also used in the manufacture of insulating and low-density board and bulk fibre. Some of the woods which have been used as raw materials in the Asplund process are Southern Yellow Pine, Jack Pine, Spruce, Hemlock, Californian Redwood, Aspen, Maple, Poplar and Oak. Asplund fibre has recently begun to acquire some importance as a starting material for some of the newer types of pulping operation. Since it consists essentially of wood in a finely divided form, it can be treated chemically to remove lignin by much milder methods than are applicable, as a rule, to standard pulping chips in the conventional pulping processes.

The success of the Masonite and Asplund processes for the production of hardboards from wood has stimulated the search for alternative means of obtaining similar types of end-product. Stamm [7] makes a brief reference to a process developed recently at the U.S. Forest Products Laboratory, whereby partially hydrolysed wood chips are defibred mechanically, formed into a thick pulp mat and pressed wet at a high temperature to form a board having a specific gravity of about 1·00 and which can be nailed. Hardwoods give a somewhat better product than softwoods. It has also been found that sheets of paper from hydrolysed wood fibres can be laminated and pressed to form a relatively dense product which cannot be nailed but is readily drilled. The properties of the product are greatly improved by the incorporation of a proportion of phenol/formaldehyde resin. A recent patent [8] discloses that, instead of laminating felted fibre sheets, dry pressing of a mixture of partially hydrolysed wood powder and cellulosic fibres (in the proportion of 2 parts of the former to 1 of the latter) yields a satisfactory hardboard. In a patent issued to Newberry [9] it is further disclosed that hardboard can be prepared by mixing 1 to 10 per cent. of a partially pre-oxidized drying oil, such as blown soybean oil, with defibred wood and consolidating under pressure at above 400° F. Considerable interest has been shown in recent months in yet another process [10] whereby, it is claimed, dry ingredients, including sawdust, shavings and other forms of wood waste, can be incorporated with a small proportion of a plasticizer (or catalyst) and consolidated at temperatures of the order of 250° C. and pressures of the order of 800 p.s.i. to form hardboard. The composition of the active ingredient in this process has not been disclosed, nor is it known for certain whether the process is operable on a large scale.

When considering the utilization of wood waste which is widely dispersed in small lots, it is natural to think that, by securing the waste itself at little or no cost, and by minimizing transport costs, it should be possible, economically, to convert it *in situ* into products such as building boards by some of the simpler of the processes mentioned above or by the use of suitable binders. To a certain extent binders, such as Portland cement and hot- or cold-setting synthetic resins, are being used commercially at the present time to make boards which are suitable for internal wall or ceiling linings and partitions. It is extremely doubtful, however, whether, in normal times, such local enterprises would be able to compete in the open market with the mass production of large plants operating on well established processes. In this connexion Stamm [7] has pointed out that, if all who have contemplated production of board materials actually go into production, a state of over-production will be inevitable. Furthermore as Fellows [2] has said, 'it would be wise to regard any programme for the disposal of "waste" not as an end in itself, but rather as a stepping stone to better rationalization of production'. This means that so-called waste, which cannot be collected in sufficient quantities and adapted to form part of the raw material of an efficient chemical process, must be turned locally to any use, however humble, until such time as the whole process of wood conversion is rationalized so that waste, as such, can no longer exist.

(3) SAWDUST, SHAVINGS, ETC.

This material represents wood waste in its most troublesome and abundant form. Despite a long list of uses for which sawdust, in one form or another, has been found invaluable, no single process has yet been discovered which will absorb this material continuously by the thousands of tons and convert it economically into useful products. The enormous demand for ethyl alcohol (normally prepared by fermentation from molasses and grain and, to some extent, synthetically from waste petroleum gas) during the recent war focussed attention on certain well-known hydrolysis processes, such as those developed by Scholler and Bergius in Germany. By these and similar processes, the carbohydrate components of sawdust etc., are hydrolysed with acids to yield hexose and pentose sugars. The hexose sugars are fermentable with brewers' or bakers' yeast (*Saccharomyces* sp.) to yield ethyl alcohol. Fodder yeast (*Torula* sp.) utilizes both hexose and pentose sugars. The Scholler, or dilute sulphuric acid process, and the Bergius, or concentrated hydrochloric acid process, were both used in Germany during the recent war mainly to produce fodder yeast. Few reliable data are available concerning the economics of either process [11] but the dilute sulphuric acid process is preferable on technical grounds. During the past few years the Scholler process has been thoroughly investigated in the United States with a view to finding an additional source of ethyl alcohol for the synthetic rubber industry, and the erection of a full-scale plant was commenced in 1944 to produce some 4 million gallons of 95 per cent. ethyl alcohol per annum from Douglas Fir waste by a much improved version of the original process. A series of papers representing the very substantial contribution of American investigators to the study and application of wood hydrolysis was published in 1945 [12]. Full scale operational data for the new American plant are not yet available, but Tousley [13] has made a comprehensive economic survey of alcohol production in the United States, and reached the conclusion that profitable production in that country of ethyl alcohol from wood waste is by no means assured. Much will depend (*a*) on future supplies of molasses and (*b*) on whether the production of synthetic alcohol is extended. Even if fodder yeast is produced as an alternative to ethyl alcohol, the economics of wood hydrolysis may be no more promising. Petersen, et. al. [12] have indicated that it is doubtful whether yeast protein can be produced at a price to compete with soybean protein, which sells in the United States at approximately 5 cents per pound. To this somewhat depressing economic forecast it must be added that approximately one-third of the wood submitted to hydrolysis is left behind as a solid residue consisting substantially of lignin. No market is at present available to absorb the whole of this by-product, and, until such a market is found through further chemical research, the economics of all hydrolysis processes claiming to afford a substantial contribution to the solution of the wood-waste problem will remain in doubt.

What has been said of chemical utilization of sawdust applies in large measure to shavings and planer chips. During the present paper shortage it is often asked why such material cannot be converted into paper. A considerable bulk of shavings and planer chips has, in fact, been used in conjunction with cereal straw for paper manufacture in Great Britain. The pulping characteristics of sawdust, slabs and chip screen rejects have recently been examined in the United States [14]. The conclusion was reached that, although these materials can be pulped, there are certain objections to them. The greatest objections are the dirt content of the pulp produced, the low strength characteristics of the pulps and the damage to equipment caused by sand added to the cooking system from these materials. Another use for sawdust which has been revived is the manufacture of oxalic acid, and a detailed consideration of this process was published in 1942 [15].

One of the most striking developments of the recent war was the way in which Sweden was obliged to use thousands of tons of wood pulp which she was unable to export. By a modification of the sulphite process she was able to obtain an increased yield of fuel alcohol from the waste liquors by fermentation, and animal fodder from the cellulose pulp. That cellulose is readily digestible by cattle, sheep and goats has been known since the latter part of the nineteenth century, and this fact was exploited in both Germany and Sweden during the 1914-18 war. The developments in cellulose feeding which have taken place in Sweden since then are fully described in a paper by Edin [16]. The question naturally arises why sawdust cannot be converted into a cellulosic fodder. Theoretically this is quite feasible, provided the sawdust is substantially freed from the lignin, which is itself indigestible, and, because of its close association with cellulose in the wood cell wall, prevents the cellulose in raw sawdust from being digested. During the war a process was developed in Great Britain [17] on a laboratory scale for making cellulosic fodder from sawdust. In this process it was proposed to use waste nitric acid as the delignifying agent. So far it has not been found possible to apply this process on an industrial scale.

In an article of this type it is not possible to present more than a general picture, so that some aspects of the chemical utilization of wood have had to be omitted if only for the sake of brevity.

The following literature references should, however, enable any reader to obtain more detailed information on specific processes.

References

[1] Hawley, L. F. Wood distillation, p. 125 et seq. Chem. Catalog Co., New York, 1923.

[2] Fellows, E. S. The preparation and marketing of Spruce sawmill 'waste' for chemical pulp chips in Quebec and Maritime Provinces. Department of Mines and Resources, Ottawa, Canada. 1940.

[3] Sankey, C. A., and Rosten, M. M. Alcohol from waste sulphite liquor. *Pulp Paper Mag. Can.* 45, 1944 (171–178, 188).

[4] Potter, G. J. C. Cellulose and other chemical products from wood (excluding paper). Department of Mines and Resources, Ottawa, Canada. 1939.

[5] Lee, J. A. New products from wood. *Chem. metall. Engng.* 47, 1940 (95).

[6] Lowgren, U. Asplund defibrating process. *Paper Tr. J.* 113, 1941 (TAPPI Sect. 119–122).

[7] Stamm, A. J. Chemical utilization of wood; its opportunities and obstacles. *J. For.* 44, 1946 (258–265).

[8] Elmendorf, A. Hardboard. *U.S. Patent* No. 2,381,269, 1945.

[9] Newberry, J. R. Hardboard. *Canad. Patent* No. 428,103, 1945.

[10] Anon. Hard wallboard made from sawdust. *Sci. News Lett., Wash.* Sept., 1945 (184). *Timb. Tr. J.* 176, 1946 (258).

[11] Campbell, W. G. The production of sugar, alcohol and other products from wood. *Chem. & Ind.* 60, 1941 (47).

[12] Sugars from wood. *Industr. Engng. Chem.* (*Industr. Ed.*) 37, 1945:—
Sherrard, E. C., and Kressman, F. W. Review of processes in the U.S. prior to World War II. (5–8).
Faith, W. L. Development of the Scholler process in the U.S. (9–11).
Harris, E. E., Beglinger, E., Hajny, G. J., and Sherrard, E. C. Hydrolysis of wood (12–23).
Peterson, W. H., Snell, J. F., and Frazier, W. C. Fodder yeast from wood sugar (30–35).
Plow, R. H., Saeman, J. F., Turner, H. D., and Sherrard, E. C. Rotary digester in wood saccharification (36–43).
Saeman, J. F. Kinetics of wood saccharification (43–52).
Hasche, R. L. By-products of wood saccharification (52–54).

[13] Tousley, R. D. Economics of industrial alcohol. *Bull. Bur. econ. bus. Res., Wash. St. Coll.* No. 3, 1945 (69).

[14] Hill, E. H. Substitutes for round Pine wood in making alkaline pulps. *Paper Tr. J.* 119, 1944 (TAPPI Sect. 185–187); *Paper Ind.* 26 (5), 1944 (640).

[15] Othmer, D. F., Gamer, C. A., and Jacobs, J. J. Oxalic acid from sawdust. Continuous fusion process. *Industr. Engng. Chem.* (*Industr. Ed.*) 34, 1942 (268).

[16] Edin, H. The qualification of wood pulp for use as fodder. *Svensk. Papp.Tidn.* 43, 1940 (145–151).

[17] Campbell, W. G., and Packman, D. F. Improvements in and relating to the production of cellulose from lignin-containing cellulosic material. *Brit. Patent* No. 572,728, 1945.

II. THE UTILIZATION OF SAWDUST AND WOOD CHIPS

By P. Harris, B.Sc. (Eng.), A.M.I.Mech.E.

Forest Products Research Laboratory, Department of Scientific and Industrial Research

The utilization of sawdust and wood chips produced in the various woodworking operations constitutes a difficult problem in many instances. Though sawdust has numerous industrial uses, requirements are chiefly for specific grades, and profitable disposal often depends on the outlets being near to the point of production. Transport of wood waste in these bulky forms is both costly and troublesome, though the matter is sometimes facilitated by baling the wood chips and shavings under pressure. The sawdust produced in the conversion of green timber presents most difficulty, for not only is it in a damp condition, but it may include bark and consist of a mixture of species. There are few uses for such material, apart from a small consumption for floor sweeping and the protection of freshly-laid concrete. It can be used as a fuel in special types of furnace, but its calorific value is low on account of the high moisture content (50 to 100 per cent. based on dry weight). The possibility of finding other uses is increased, of course, if bark can be removed from the logs before conversion and the species be kept separate. The drying of damp sawdust is not an economic proposition, owing to the special plant and large amount of heat required, and is worth while only in exceptional cases.

The product from the re-sawing of seasoned and partly seasoned timber is fairly dry and clean, and outlets can often be found when the mill is favourably situated. For some uses sawdust from a particular species and of certain grades of fineness are required. Shavings and chips from planing, moulding, turning or other machine and hand operations are usually produced from seasoned timber and are, therefore, reasonably dry. They form a satisfactory fuel, provided the firing arrangements are suitable, and their other uses are mainly for packing and animal bedding. In pre-war years, many manufacturers installed grinding machines of the swing-hammer type to break down their chips into grade sawdust for which there was a steady demand in various industries. It is doubtful whether such conversion is profitable under present conditions, as the cost in power is high and there are fewer outlets for this class of material.

The chemical utilization of wood waste has been discussed in the preceding paper and the present article is concerned with the various physical uses for sawdust and chips as detailed below. Mention may be made here of one chemical aspect—destructive distillation as applied to these materials. Charcoal and the by-products of carbonization can be obtained from wood in this form, but economic production is only possible if carried out on a very large scale. Plant of special design is needed and the most favourable conditions, including an abundant local supply of raw material, are essential. The finely divided charcoal so produced requires in most cases further processing before it can be put to use. In one process, the charcoal is mixed with coal-tar pitch as a binder and pressed into briquettes which are subsequently stoved to remove the lighter fractions of the tar.

FUEL.

(1) *Raw Material.*

The most efficient method of utilizing sawdust and wood chips is usually as fuel for heating or power purposes. Utilization in this manner must take place at the mill or factory where the material is produced, for the use of transport is bound to be uneconomic. As a fuel, wood waste has the disadvantages of a low calorific value owing to the presence of moisture, a light weight in relation to its bulk, and possible troubles in flues through the escape of tarry gases if combustion be incomplete. Special furnaces are needed for efficient burning of sawdust and chips, but ordinary boiler furnaces can be used if the material be burned in conjunction with a solid fuel such as coal. The latter must be fed to the back of the grate and the waste in front, so that the gas from the wood can burn in the space above the glowing coal. Wood burns with a considerable amount of flame and, if used as the sole fuel, there must be adequate combustion space and good air control to prevent a proportion of the gases burning in the wrong place, or failing to burn and being lost. It is customary, therefore, to fit boilers with some form of pre-furnace when sawdust and wood chips are to be the fuel. The Dutch oven, stepped-grate furnace, 'Risborough' hopper furnace or special arrangements for burning the waste in suspension can be employed for the purpose. For domestic heating purposes, various types of stove designed for burning sawdust are available. They range from two-drum stoves, operating on the principle of burning by means of a natural flue in a partly compressed mass of the fuel, to the Canadian type which consists of a hopper, sloping feed plate or stepped-grate and small combustion chamber. Further information on the utilization of wood waste as fuel is given in Laboratory publications [16] [19] [20]. When the waste cannot be employed usefully as fuel or for other purposes, a convenient method of disposal is burning in an incinerator. Destruction of the waste at its source has the advantage of avoiding unsightly dumps that are wasteful of space or the cost and trouble of cartage from the mill. The ashes have some value as a fertilizer as they contain a small amount of potash. The Dutch oven or the hopper type furnace can be used, but there are various special forms available on the market.

Solid wood waste and chips are used as fuel in gas-producers for power purposes, and a certain amount of sawdust may be included. The latter is seldom burned alone, as it is likely to cause trouble through arching or irregular burning in the generator. The finer dust tends to pass over with the gas and clog the pipes leading to the gas cooling and cleaning apparatus. Special forms of producer have been designed in the past for operation solely with sawdust, but few appear to have been really successful. It is the usual practice, when sawdust has to be employed in ordinary types of gas-producer, to mix it with planer, hammer mill or hogged chips. A mixture of about two parts of the latter with one part of sawdust is reported to give satisfactory results, but a greater proportion of sawdust may be used in certain types of plant.

(2) *Fuel briquettes.*

Wood waste can be manufactured into fuel briquettes but hitherto they have been unable to compete with coal or even coal-dust briquettes in this country. There are four main methods of production:—

(*a*) High pressure, without the use of a binding agent. The method is employed in America, chiefly in the Western States, where the briquetting of sawdust has met with considerable success. Production has to be carried out on a very large scale, requires elaborate, costly plant, and has not yet been found practicable in Great Britain.

(*b*) Medium pressure with a binding agent. Briquettes can be made in the various types of press used for coal-dust briquetting from a mixture of sawdust, or chips, and a binder, such as coal-tar pitch, petroleum residues, waste sulphite liquors or other suitable material. The plant is not unduly elaborate but a special drier is needed for dealing with damp wood waste, and an abundant supply of cheap binder is essential for success. Where the briquettes are intended for domestic heating purposes, stoving subsequent to pressing may be necessary for the avoidance of unpleasant smoke in burning.

(*c*) Medium and low pressure with a mechanical binding agent. The waste is pressed into briquettes of suitable form and bound with wire or string.

(*d*) Heat and pressure with no binder. The sawdust is dried, heated to 300° to 400° C. for semi-carbonization, pressed and given further heat treatment to expel smoke-producing agents. Various patent processes have been developed in Europe and America and successful production has been obtained in certain cases. A method involving the combination of heating and extrusion appears to be the most promising for development in this country.

The average net calorific value of compressed dry sawdust is slightly more than 8,000 B.Th.U. per lb. in comparison with 12,000 to 13,000 B.Th.U. for coal. The presence of an inert binder in the briquette will lower the calorific value, whereas the latter could be raised by the inclusion of coal dust or charcoal, or the use of an inflammable binding agent. Briquettes produced by method (*d*) from carbonized waste should have a value in the neighbourhood of that of coal.

(3) *Fire-lighter briquettes.*

The production of fire-lighters from sawdust and shavings has been found to be a profitable proposition, but the amount of waste consumed is not large. In some forms wood meal is used with various other ingredients, but ordinary dry sawdust mixed with petroleum residues, or melted naphthalene can be made into satisfactory lighters by a simple process. Wood chips or shavings dipped in naphthalene or other suitable inflammable compound and bound by paper strip, string or wire can also be employed.

(4) *Food Curing.*

A further use as fuel, but on a relatively small scale, is for the curing of fish, bacon and ham. Sawdust and shavings, not necessarily dry, from Oak, Beech, Elm and Scots Pine are required for the purpose.

GAS PURIFICATION.

A mixture of lime, iron oxide and sawdust, sometimes with chips, is used for gas purification. Sawdust does not itself absorb the impurities to any extent, but is added to render the mixture porous. It should not be moist, but partly seasoned material is accepted. Peat is preferred when available, as it is also an active agent in absorbing ammonia and other by-products. Increased use has, however, been made of sawdust, and in war-time it competed with peat, especially when produced near the gas-works.

SAWDUST-CEMENT.

Sawdust has been used with a certain amount of success as an aggregate in pre-cast concrete units for building purposes. The properties of this light-weight concrete can be varied by altering the proportion of cement to sawdust, the range being from 1 : 1 to about 1 : 5 by volume. The strength of the set product is reduced as the sawdust proportion is increased, and the material can be cut and nailed more easily. Sawdust cement has fairly good insulating properties but has the major disadvantage of a high initial shrinkage on drying and subsequent high dimensional changes on wetting and drying. This behaviour may induce one or more of three defects, i.e. warping during or after maturing, cracking while maturing, or cracking when in use because of rigid fixing methods. For building purposes, therefore, the material should be employed like timber, in units jointed so that they are free to move, as otherwise failure is certain. Reinforcement of sawdust-cement with steel is not economic, but in certain circumstances satisfactory results have been obtained with wood laths. Some improvement has been gained in the use of this material by control of drying in the early stages, and by careful design as regards dimensions of the units. The various forms of pre-cast product include flooring blocks, roofing slabs and units, wall slabs, nailing bricks, bench seats, shelves, and special articles for which plaster and sawdust have also been used. Hardwood sawdust of various grades and, in some cases, a mixture of hardwood and softwood dusts were used with magnesium oxychloride for composition flooring before the war. Sawdust is also the filler in some gypsum products, including plasterboards. Considerable attention has been directed in recent years to the production of wallboards from sawdust and wood chips. Various successful processes have been developed in which the dried waste, mixed with synthetic resin or other suitable binder, is formed into boards while subjected to heat and pressure.

ABSORBENT.

Non-resinous dry sawdust is a good absorbent and is used in butchers' shops, slaughter houses, markets, etc., for currying animals, for oil extraction in factories and for many similar purposes. Dry shavings and sawdust make good material for bedding in stables, cow-sheds and kennels. When available, Pitch Pine waste has been preferred for the latter purpose, owing to its reputation as being a vermin deterrent.

CLEANING AGENT.

Sawdust is employed for cleaning, drying and polishing in the manufacture of numerous metal products, including tubing, sheet metal, wire-work, pins, etc. The specified grades range from coarse sawdust to fine meal or flour, the latter being obtained from ordinary sawdust by sifting or by grinding wood chips and other wood waste in hammer mills, the finer flour being produced usually in abrasion mills. Wood meal is used to some extent in the electro-plating and jewellery trades, and is specified under three grades:—(1) Fine, averaging 60 per cent. of 30–60 mesh with up to 20 per cent. of 100 mesh; (2) medium, averaging 40 per cent. of 30–60 mesh and 40 per cent. of up to 30 mesh; (3) coarse, averaging 50-60 per cent. of 20 mesh or under, and about 10 per cent. of less than 60 mesh. The grades required depend on the size and nature of the article to be cleaned or finished. Box and Beech meal is preferred for jewellery, Douglas Fir and Hemlock for brass and electro-plating, but other woods that are free from resin and chemically inactive may be accepted, the moisture content being between 5 and 10 per cent. The material is used chiefly in tumbling barrels but in some cases the cleaning operation is carried out in heated trays.

Dry Beech sawdust in grades of 16 mesh and finer is used for the cleaning of furs. The light leather industry uses sawdust for dressing skins. Clean, fairly dry sawdust, free from any content likely to affect or stick to the leather is required.

PACKING.

Wood chips, shavings and sawdust are well suited for packing all kinds of products, e.g. glass, china and metal ware, liquid containers, canned goods, instruments and other fragile articles. They have the advantages of cheapness, light weight, ability to absorb liquids if containers break, and, owing to good insulation properties, to prevent liquids from freezing. Clean dry material is required and, especially in the packing of metal articles, it must be free from corrosive volatile acids and other active content. Certain species of wood contain sufficient acid to cause corrosion of metals even under dry conditions, and on this account, sawdust from Oak, Sweet Chestnut and Western Red Cedar, for example, should be avoided for packing ferrous metals and lead.

INSULATION.

Dry sawdust, sometimes in admixture with chips or shavings, is used as heat insulation in floors and partition walls, cold stores, ice chests and refrigerators, and for the lagging of hot water tanks and water pipes.

WOOD FLOUR PRODUCTION AND USES.

Wood flour is produced from sawdust, chips and other wood waste by grinding in hammer mills, abrasion mills or steel burr-roller mills. The hammer, or impact grinding machine has a number of hardened steel hammers, either fixed or pivoted to discs on a revolving shaft, which beat the wood waste into small particles. A screen of suitable mesh, partly surrounding the hammer assembly, is used in separating flour coarser than 60 mesh, but for finer grades, air is drawn through the beating chamber and carries away the fine dust. The size of particle collected can be controlled by the speed of the air. The abrasion, or stone mill consists of two grinding stones made from suitable abrasive material, one stationary and the other revolving, enclosed in a metal casing. The material to be ground is introduced through an opening at the middle of the fixed stone and, after reduction, passes out at the periphery. The flour is then drawn, or blown to collecting and screening plant, rejected material (tailings) being returned to the mill for re-grinding. The burr-roller mill is not used to any extent in wood-flour production. It has several pairs of serrated steel rollers, each succeeding pair having teeth of diminishing size. The two rollers revolve in opposite directions at different speeds and are set close together.

Abrasion mills produce the best grades of flour, but require skilful operation and have to be fed with a uniform, fairly fine sawdust. It is necessary to employ hammer mills for breaking down coarse sawdust, planer chips, shavings and solid wood waste such as edgings and small offcuts, into meal of about 16 mesh or finer before grinding into flour in abrasion mills. The waste has to be in a moderately dry condition when fed to a hammer mill, for damp flour is troublesome to collect and screen. Considerable heat is generated in abrasion mills, however, and almost dry flour is produced if the raw sawdust contains less than 25 per cent. moisture.

Many industries use wood flour and, in most cases, the requirements as to grade, colour, species of wood, purity and moisture content are fairly exacting. Usually the latter must not exceed about 5 per cent., and light colour is specified when the material is employed as a dyed filler, for example, in the manufacture of linoleum and in the plastic industries. Flour from Pine and Spruce is used chiefly for plastics, the resin content being restricted in general to 1 per cent. Douglas Fir and Teak flour are preferred for plastic electrical goods. Hardwood flour is needed for various special purposes and a particular wood may be specified such as Beech, Birch, Oak, Ash or Mahogany. Other uses for wood flour or meal are in the manufacture of explosives, dry batteries, incrusted wallpaper, roofing felt, composition flooring, polishing and grease-removing compounds, disinfectant powders, and toys. It is also used for packing purposes and for firing clay products to give porosity, though flour and fine sawdust are now being replaced by special 'foamers'. Various grades of meal are consumed in the electro-plating and jewellery trades as previously mentioned, and in the manufacture of aluminium sheet, tin plate and other metal products.

BIBLIOGRAPHY

[1] An improved composition for the manufacture of floor, wall and/or roof tiles. *Brit. Patent* No. 439,273, 1936.

[2] An improved plastic self-hardening composition. *Brit. Patent* No. 480,881, 1938.

[3] Apparatus for combustion and heating. *Brit. Patent* No. 266,351, 1927.

[4] BEECHER, H. W., and WATT, R. D. Combustion of waste wood products. (Paper presented to American Society of Mechanical Engineers, September 1940.) *Engineering* 150, 1940 (474).

[5] BENSON, H. K. Chemical utilization of wood. Twenty-second Report of the National Committee of Wood Utilization. U.S. Department of Commerce, Washington, 1932.

[6] BOAS, I. H. Wood-waste. *Bull. Inst. sci. industr. Res. Aust.* No. 19, 1921, pp. 82.

[7] Briquetting of sawdust. *Timb. Tr. J.* Nov. 24, 1928 (XXXIII).

[8] Briquetting of wood waste. *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*842, 1939.

[9] Building material prepared from a mixture of sawdust or sawmill waste, with cement and calcium oxychloride, with or without the addition of trass or powdered brick. *Brit. Patent* No. 269,845, 1927.

[10] Campbell, W. G., and Packman, D. F. Wood as a causal factor in the corrosion of metals. *Wood* 9, 1944 (99–101).

[11] Dahl, W. S. Wood flour. *Wood* 2, 1937 (357).

[12] —— Wood flour. The Mercury Press, Northampton, 1944.

[13] Development in wood technology. *Engineering* 150, 1940 (461).

[14] Friedlander, C. J. Wood flour from wood waste. *Timb. Tr. J.* 139, 1936 (XIX).

[15] —— Wood waste and wood flour. *Wood* 2, 1937 (296).

[16] Furnaces and stoves for burning sawdust. *Leafl. For. Prod. Res. Lab., P. Risborough*, No. 26, 1942.

[17] Gillham, R. B. The utilization of wood refuse for steam raising. Institution of Mechanical Engineers, London. 1942. pp. 12.

[18] Graf, S. H., and Johnson, R. H. The properties of cement-sawdust mortars, plain and with various admixtures. *Bull. Ore. agric. Engng. Exp. Sta.* No. 3, 1930.

[19] Harris, P. Burning sawdust. *Wood* 7, 1942 (70–72).

[20] —— Utilization of wood waste as fuel. *Fuel Econ. Rev.* 22, 1943 (30–33).

[21] Hubbard, E. The utilization of wood-waste. Scott, Greenwood & Son, London, 1920.

[22] Improvements in and relating to furnaces. *Brit. Patent* No. 371,998, 1932.

[23] Improvements in or relating to concretes or plastic masses comprising cement and sawdust. *Brit. Patent* No. 321,744, 1930.

[24] Improvements in or relating to incinerators and the like. *Brit. Patent* No. 382,039, 1932.

[25] Improvements in or relating to the destruction of comminuted material. *Brit. Patent* No. 495,720, 1938.

[26] Improvements in processes of mineralizing fibrous materials, particularly sawdust, and in fibre and cement bodies or compositions. *Brit. Patent* No. 225,912, 1924.

[27] Improvements in sawdust burning stoves. *Brit. Patent* No. 182,362, 1922.

[28] Improvements in stoves for burning sawdust and like residues. *British Patent* No. 197,325, 1923.

[29] Improvements relating to slow combustion heating stoves. *Brit. Patent* No. 271,733, 1927.

[30] Jenkins, J. H., and Guernsey, F. W. The utilization of sawmill waste and sawdust for fuel. *Circ. Dom. For. Serv. Can.* No. 48, 1937.

[31] Kreisinger, H. Combustion of wood-waste fuels. *Mech. Engng., N.Y.* 61, 1939 (115–121).

[32] Porter, H. A. Profitable utilization of wood waste. *Timberman* June, 1927 (178, 180, 182).

[33] Process for treating organic fibrous materials for the manufacture of light-weight concrete. *Brit. Patent* No. 480,740, 1938.

[34] Sawdust, wood flour, shavings and excelsior. National Committee on Wood Utilization, U.S. Department of Commerce, Washington. 1941.

[35] Sawdust concrete. Department of Scientific and Industrial Research, Building Research Station, Garston, Herts. June, 1941.

[36] Soehner, X. Power production from tropical vegetable waste. *Engineering* 143, 1937 (569–572, 599–600).

[37] Sprague, J. C. Characteristics of sawdust concrete. *Civ. Engng., Lond.* 9, 1939 (316).

[38] Steidle, H. H. Wood flour industry. *Timberman* July, 1930 (172–174).

[39] Stevens, W. C., and Steel, E. A. Drying sawdust. Standardized emergency equipment to meet present conditions. *Wood* 6, 1941 (19–21).

[40] Stillman, A. L. Briquetting. The Chemical Publishing Co., Easton, Pa. (Williams & Norgate, Henrietta Street, London, W.C.2) 1923.

[41] The corrosion of metals by wood. *Timb. and Plyw.* 79, 1940 (348); *Timb. Tr. J.* 154, 1940 (330).

[42] The mechanical development of a wood-briquetting machine. *Mech. Engng., N.Y.* 63, 1941 (105).

[43] Uses for sawdust and shavings. *Leafl. For. Prod. Res. Lab., P. Risborough*, No. 25, 1942.

[44] Utilization of sawdust. *Mon. News Lett. Div For. Prod. Aust.* No. 113, 1941.

[45] Wood flour. A general statement of the manufacture and use of wood flour and the status of the industry. *Mimeo. U.S. For. Prod. Lab., Madison* No. R565 (revised), 1941.

[46] Wood refuse as fuel. *Mech. World* 106, 1939 (339); *Overseas Engr.* 14, 1941 (216–219).

[47] Wood waste and its uses. The utilization of sawdust for the production of gas and its value as a polishing agent. *Timber News* No. 1945, 1933 (34).

3. FOREST UTILIZATION. FOREST TECHNOLOGY.

[277]. 3(51):07.2:09.7. **Forest Products Laboratory [Kaiting, Sze.]: a brief account of its plan and works with abstracts of some publications (September 1939–December 1944).** National Bureau of Industrial Research, Ministry of Economic Affairs, China. 1945. pp. 92 + map. [Chin.E.]

[278]. 3 (73) : 07.2. **Wartime research at Madison.** *Timberman* 47 (1), 1945–46 (70, 72, 74, 76, 78, 80, 82).

A general account, given to the press, of research carried out at the Forest Products Laboratory, Madison, for war purposes.

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

[279]. 31. MOENAERT, P. Le bois, materiau moderne. **[Wood, a modern material.]** *Bull. Soc. for. Belg.* 52 (1–6), 1945 (1–27). [F.[I.M.I.

A review of modern uses of wood as an engineering material and as raw material for industry.

31.0. *General Information on Woods*

[280]. 31.0 (73). **Some useful trees of the United States.** U.S. Forest Service. 1941–43. pp. 112.

A series of 28 illustrated leaflets, dealing briefly with distribution, identification, utilization, and silvicultural characters of the principal commercial species of the United States.

[281]. 31.0 (73). BETTS, H. S. **Western White Pine (*Pinus monticola*).** U.S. Forest Service: *Amer. Woods* 1945. pp. 5.

Also pamphlets in this series, by the same author, on Douglas Fir (*Pseudotsuga taxifolia*) (pp. 8); Western Hemlock (*Tsuga heterophylla*) (pp. 8); Tupelo (*Nyssa* spp.) (pp. 8); Cottonwood (*Populus* spp.) (pp. 8); Black Cherry (*Prunus serotina*) (pp. 4); Black Locust (*Robinia pseudoacacia*) (pp. 5). [Cf. *For. Abstr.* 6 (166).]

[282]. 31.0 (81) : 01.2. ARANHA PEREIRA, J., and MAINIERI, C. Nomenclatura das madeiras nacionais. **[Nomenclature of native woods.]** *Bol. Inst. Pesq. technol. S. Paulo* No. 31, 1945 (29–55). [Port.]

After outlining the basic principles on which the selection of recommended names has been made, the authors present a comprehensive table showing the commercial, botanical and common names of 145 Brazilian timbers, followed by shorter indexes containing numerical references to the main table: (1) index of common names of timbers, (2) index of common names of trees, and (3) index of botanical genera. A list of *Eucalyptus* spp., with numerical references to test data tables appearing in the same bulletin [see *For. Abstr.* 8 (No. 292)] is appended.

[283]. 31.0 : 12.26–8. **The properties of Australian timbers: Coachwood [*Ceratopetalum apetalum* D. Don].** *For. Prod. News Lett. C.S.I.R. Aust.* No. 139, 1946 (4).

[284]. 31.0 : 12.26–8. **Specimen woods No. 123: Mora (*Mora excelsa*).** *Suppl.* to *Wood* 11 (3), 1946 (43–4).

31.1. *Structure. Anatomy. Identification*

[285]. 31.1. NORMAND, D. Dissociation des éléments histologiques du bois. **[Separation of the histological elements of wood.]** *Bull. Soc. bot. fr.* 91 (7/8), 1944 (180–2). [F.] X.

After briefly reviewing several established methods of macerating woody tissues, the writer gives details of a technique, which he has developed and found satisfactory, using alcohol and nitric acid.

[286]. 31.1 (73). HESS, R. W. **Keys to American woods** (continued). *Trop. Woods* No. 85, 1946 (11–9).

The 17th, 18th, 19th and 20th keys of the series deal respectively with: woods with vasicentric tracheids, fibres with spiral thickenings, special fibres in parenchyma-like arrangement, and woods with unilaterally paratracheal parenchyma.

[287]. 31.1 (922). JANSSONIUS, H. H. Anatomische Bestimmungstabelle für die Javanischen Hölzer. **[Anatomical key for the determination of Javanese woods.]** E. J. Brill, Leiden. 1940. pp. vii + 239 [G.]

An independent supplement to the author's 'Mikrographie des Holzes der auf Java vorkommenden Baumarten', containing a general key (128 pp.) down to genus and species, a few special keys (pp. 12) to large genera, 365 line drawings (mostly of transverse sections only) taken from the main work, and a specific index. Cross references to the main work are given for each species in the general key.

[288]. 31.1 : 12.11.16 : 31.3. HARRAR, E. S. **Note on starch grains in septate fiber-tracheids.** *Trop. Woods* No. 85, 1946 (1–9 + plates). [School of Forestry, Duke Univ.]

Deposition of starch in prosenchymatous tissue has not received much attention hitherto. The author of the present article examined 2,253 species of wood with septate fibre-tracheids, included in 620 genera and representing 78 families. To determine the presence of starch in stained and mounted material, use was made of a petrographic microscope. Starch grains were observed only in those woods where longitudinal parenchyma was exceedingly sparse or entirely lacking and to a greater extent in heartwood than in sapwood, which suggests that, in the absence of normal storage tissue, septate fibre-tracheids may, and probably do, serve in a parenchymatous capacity. Starch grains were observed in one or more species of each of the following genera: *Anisacanthus*, *Sanchezia*, *Astronium*, *Odontadenia*, *Bursera*, *Casearia*, *Ryania*, *Sickingia*. Crystals were commonly present in the septate fibre-tracheids of heartwood material of one or more species in each of the following genera: *Dendropanax*, *Didymopanax*, *Banara*, *Coccoloba*, *Castanospora*, *Chytranthus*, *Cupaniopsis*, *Diatenopteryx*, *Euphoria*, *Exothea*, *Mischocarpus*, *Sarcopteryx*, *Schmidelia*.

[289]. 31.1 : 21.8 : 12.26–8 : 12.11.14. MÜLLER, D. Hvorfor springer Eg og Ask saa sent ud? Forskellen mellem ring- og spredtporede Løvtræer. **[Why are Oak and Ash so late in flushing? The difference between ring- and diffuse-porous hardwoods.]** *Dansk Skovforen. Tidsskr.* 28 (4), 1943 (158–66). [Dan.]

A brief review of literature, based largely on the work of Priestly and Huber, on physiological differences between ring- and diffuse-porous woods, with particular reference to water conduction. Late foliation of the ring-porous species appears to be connected with the concentration of water conduction into the latest annual ring only and the need to have cambial activity in progress before the leaves appear.

31.2. *Physical Properties*

[290]. 31.2 : 12.25 (44). PESTRE, M. Essais de qualification physique et mécanique de quelques bois exotiques provenant de l'Arboretum des Barres. **[Tests of the physical and mechanical properties of certain exotic woods from the Arboretum of Les Barres.]** *Ann. Éc. Eaux For. Nancy* 8 (2), 1942 (280–91 + plates). [F.] [Laboratoire Central d'Essais des Bois, Paris.]

Results of tests made in 1942 on wood of the following exotic species grown at Les Barres: *Pinus laricio*, *P. ponderosa*, *P. coulteri*, *Larix decidua*, *Abies nordmanniana*, *Cedrus atlantica*, *Juniperus virginiana*.

[291]. 31.2 : 07.7. ABRANCHES BROTERO, F. Métodos de ensaios adotados no I.P.T. para o estudo das madeiras nacionais (2ª. edição). **[Testing methods adopted by the Instituto de Pesquisas Technólogicas in the study of native woods (2nd edition).]** *Bol. Inst. Pesq. technol. S. Paulo* No. 31, 1945 (7–28). [Port.]

A summary of methods used by the Technological Research Institute, São Paulo, for testing the physical and mechanical properties of wood.

[292]. 31.2 (81) : 31.0. ABRANCHES BROTERO, E., and VIEIRA, A. Tabelas de resultados obtidos para madeiras nacionais. **[Tables of results obtained from [tests on] native woods.]** *Bol. Inst. Pesq. technol. S. Paulo.* No. 31, 1945 (29 + tbls.) [Port.]

Five tables giving data on the physical and mechanical properties of 250 wood samples representing over 150 Brazilian species, which are arranged according to their specific weight. [Cf. *For. Abstr.* 8 (No. 282).]

31.21. Conductivity

[293]. 31.21.4. MACLEAN, J. D. **Rate of temperature change in short-length round timbers.** *Trans. Amer. Soc. mech. Engrs.* 68 (1), 1946 (1–16). P.R.

A discussion of factors affecting the rate of temperature change in wood, including time-temperature curves for use in determining the temperature obtained at different points in short-length log sections when heated in steam or hot water. One group of curves shows the temperature distribution from the ends to the mid-length and at different points between the circumference and axis, of logs 12, 24, 36, 48, and 60 in. in diameter. Other charts show the time–temperature distribution at various points between the circumference and axis at the mid-length of log sections of any diameter between 12 and 60 in. Examples are given illustrating the procedure for using the charts in finding the temperature at a particular point, under different heating conditions. *Author's summary.*

31.27. Mechanical strength

See also *For. Abstr.* 8 (Nos. 636–7).

[294]. 31.27. PERELȲGIN, L. M. Vliyanie skorosti nagruzheniya pri mekhanicheskikh ispȳtaniyakh drevesinȳ. **[Influence of rate of loading in mechanical tests of wood.]** *Lesnaya Prom.* No. 5/6, 1945 (16–9). [Russ.]

Tests were made on small clear samples, taken from the same piece of wood and at stable moisture content, to determine the effect of rate of loading on strength in compression along the grain (Larch, Pine, Oak, Ash, Beech, Spruce and Aspen) and perpendicular to the grain (Pine, Oak, Lime), tension along the grain (Larch) and perpendicular to the grain (Pine, Aspen), static bending (tangential; Pine, Ash, Birch), shear strength (radial; Pine, Ash), fissibility (radial; Pine) and hardness (transverse; Pine).

Results (tables and graphs) show that a regular correlation existed between rate of loading and resistance values; resistance increased with increasing rate of loading and the increases in resistance were more marked in the lower range of values for rates of loading, the curves for resistance plotted against rates of loading being steep at first but soon flattening out and approaching constancy at the higher rates. The effect of rate of loading differed in magnitude in the different types of test and was shown most clearly in tests of compression along the grain and of static bending. It was also more clearly evident for woods of high than for those of lower mechanical strength. Similar results were obtained in mechanical tests of non-laminated ('lignoston' type) and laminated ('lignofol' type) compressed wood. On the basis of these results it is urged that, to give comparable values, the rate of loading in mechanical tests should be high enough to ensure that the results do not lie on the steep portion of the curve for the relationship. The rate of loading recommended by the 4th congress of the International Association for the Testing of Materials (20 kg. per sq. cm. of working section per minute) appears to be much too low.

[295]. 31.27 : 12.25. CARDOSO DA SILVA, H. Ensaios estáticos de madeiras em dimensões estruturais. Observação: Métodos de ensaio adotados e resultados obtidos para o pinho do Paraná (*Araucaria brasiliensis*). **[Static tests of structural timbers. Test methods used and results obtained with *Araucaria brasiliensis*.]** Instituto Nacional de Technologia, Rio de Janeiro. 1942. pp. 35 + plates. [Port.]

[296]. 31.27 : 12.25 : 22.89. CONNECTICUT. **Connecticut Agricultural Experiment Station: report of the Director for the year ending October 31, 1944.** *Bull. Conn. agric. Exp. Sta.* No. 484, 1945 (55–103).

Some 7,000 tests and measurements have been made in order to determine the strength properties of plantation-grown conifers. A preliminary analysis of the data from the indigenous species indicated that the wood is weaker than that of the same species grown in natural stands (p. 81).

[297]. 31.27 : 12.26–8 : 33.15.4. BOLLER, K. H. **Impact resistance of three core materials and six sandwich constructions as measured by falling-ball tests.** *Rep. U.S. For. Prod. Lab., Madison.* No. 1543, 1946. pp. 6 + tbl. + figs. P.R.

This report presents data on the impact resistance of three core materials: (1) Balsa, (2) hard, synthetic, sponge rubber (a proprietary product), and (3) cellular cellulose acetate, as measured by impact of a falling ball. Each was tested separately and in combination with two facing materials, aluminium and resin-impregnated glass cloth. The deflection caused by each drop was found to be proportional to height of drop until a 'critical deflection' was reached. Beyond this point, deflection increased much more rapidly.

Hard sponge rubber and cellular cellulose acetate core materials were about equal in resistance to damage and the Balsa wood was inferior to them; the aluminium and the glass-cloth facings were about equal. The heights of drop at the critical deflection indicated essentially the same comparisons. *From author's summary.*

[298]. 31.27 : 33.4 : 33.8. BROKAW, M. P. **Methods for testing and evaluating cargo flooring for transport aircraft.** *Rep. U.S. For. Prod. Lab., Madison* No. 1550, 1945. pp. 18 + figs. P.R.

In order to develop test methods and standards for the evaluation of types of flooring used in transport aircraft, a number of tests were carried out on eleven types of cargo flooring. Weights of the flooring in the condition in which they were received, and absorption of water after 48 hours' immersion are given. Specimens were subjected to tests for strength and durability under abrasion, friction with rough sole leather, corrosion, static bending, uniform loading, strip loading, concentrated loading, impact loading and rolling load. Methods of testing are described and illustrated in the report and the results are analysed and given in graph form. An appendix describes tests made on Maple plywood flooring.

[299]. 31.27 : 38.2 : 31.25 : 33.36. CAMPREDON, and GAUTHIER, P. Compte rendu d'essais divers sur les propriétés mécaniques des bois et la résistance des assemblages (1943–1944). **[Account of various tests on the mechanical properties of woods and the strength of constructions (1943–1944).]** *Bull. tech. Serv. cent. d'Essais des Bois, Paris* No. 2, 1945. pp. [24] + [14]. P.R.

Two reports, made by MM. Campredon and Gauthier respectively at two conferences of the Technical Institute of Building and Public Works in 1944, dealing with experiments carried out in the timber laboratory of the National Timber Institute of France.

Series H. No. 13, *Part I. Studies of the distortion of wood under permanent loads*—Specimens were tested to compare the effects of continuous loads, intermittent loads (applied one day in two), and alternate loads (the specimen turned every two days). In the first two cases the deflection after five months was more than twice as much as the original. In the third case no increase in the initial deflection was observed. In similar tensile and compression tests to determine whether the initial effect of the load increased with time, no increase appeared in the tensile tests, but a marked one was observed in the compression tests.

Part II. Experiments to test and compare the strength and efficiency of various types of timber construction without metal fastenings, and a type of construction with steel pins—The types are illustrated and results of tests are given in graphical and tabulated form.

Part III. Tests for estimating the hardness of wood—The adaptation to wood of the Brinell and Janka ball tests for metals is discussed. Methods and tests on various species are described and results given. Suggestions for the type of apparatus to be set up are made.

Part IV. Influence of the angle of the force to the general direction of the fibres. Specimens of various indigenous species were subjected to compression, tensile, static and dynamic load tests, with the general direction of the fibres set at various angles. Tests are described and results given in tabulated and graphical form. At angles of more than 5°, resistance showed a marked decline. Shock tests produced the sharpest decline in resistance with an increase of the angle, while compression tests produced the slightest.

Part V. Research on various wood preservatives—Methods of estimating efficiency of wood preservatives are suggested, and the results of these tests when applied to the principal wood preservatives are given.

Series H No. 14, *Part I. Decline in the efficiency of screwed wooden structures.* Investigations were made into the behaviour, under various conditions of humidity, of wooden constructions held together by screwed plates. Specimens were oven-dried and the estimated loss of resistance calculated. It was concluded that bolted constructions are preferable where a continual check on screwed plates cannot be kept.

Part II. Localized compression tests on wood—Specimens of Maritime Pine, Oak and Beech were subjected to various kinds of compression in order to find whether the resistance of a piece of wood to localized, could be greater than to over-all compression. Tables show test results. Resistance to localized compression parallel to the grain was no greater than to over-all compression. Localized compression across the grain could be definitely greater than over-all compression.

31.3. *Chemical Properties*

[300]. 31.3 : 33.3 : 01.6. **List of publications on chemistry of wood and derived products.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*238, 1945. pp. 41. P.R.

31.4. *Durability. Decomposition*

31.41. Natural Durability

[301]. 31.41 : 12.26–8. SCHEFFER, T. C. **The decay resistance of Oak wood.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 13, 1943. pp. 6.

The decay resistance of the heartwood of White Oaks (*Quercus montana*, *Q. garryana*, *Q. alba*, and *Q. prinus*) was compared with that of several species in the Red Oak group (*Q. borealis*, *Q. coccinea*, and *Q. velutina*). Laboratory decay tests were made with wood samples from all the major Oak-producing regions near or east of the Mississippi River and one region on the Pacific coast. The heartwood of all species in the Red Oak group showed uniformly low decay resistance, whereas in the species of White Oak tested, resistance was, in general, high. Nevertheless, differences among the White Oak species themselves were substantial enough to warrant some selection for service conditions of particularly high decay hazard. Heartwood from the upper logs proved to be somewhat more resistant than that from the lower logs, and the outer heartwood was markedly more resistant than the inner. The sapwood of *Q. alba* was more resistant to decay than that of *Q. montana*, *Q. prinus*, or *Q. borealis*, but none showed sufficient resistance to be rated as durable.

[302]. 31.41 : 12.25 : 11.32. GAEUMANN, E. Influence de l'altitude sur la durabilité du bois de mélèze. **[The influence of altitude on the durability of Larch wood.]** *Repr.* from *Bull. Murith.* No. 62, 1944–45 (47–52). P.R.

The results of researches organized by H. Burger upon Larch trees aged from 75 to 360 years, felled in the canton of Grisons at altitudes varying from 460 to 2,100 metres. Yield was found to decrease at an altitude of 1,200 metres and upwards. The proportion of autumn wood in the heartwood appeared to have no relation to altitude, but the maximum resistance to decay of the heartwood was found in trees growing between 1,050 and 1,750 metres. [Cf. *For. Abstr.* 8 (No. 747).]

31.42. Attack by Plant Organisms

See also *For. Abstr.* 8 (No. 638).

[303]. 31.42.11 : 12.21. NORD, F. F., SCIARINI, L. J., VITUCCI, J. C., and PALLARES, E. S. **Alcoholic fermentation of carbohydrates and dehydrogenation of alcohols by certain wood-destroying fungi.** *Nature, Lond.* 157 (3985), 1946 (335–6). [Fordham Univ., New York 58, N.Y.]

The studies briefly described in this article were carried out on *Fomes annosus* and three species of *Merulius*. The presence of a dehydrogenating enzyme system was detected in all four fungi.

[304]. 31.42.11 : 31.3 : 12.25. RENNERFELT, E. **The influence of the phenolic compounds in the heartwood of Scots Pine (*Pinus silvestris* L.) on the growth of some decay fungi in nutrient solution.** *Svensk bot. Tidskr.* 39 (4), 1945 (311–8). [E.e.] O.B.D.

Pinosylvin proved to be a more universal poison than pinosylvin monomethyl ether for the 6 decay fungi tested. It was active, in a nutrient solution, in a concentration of 0·02–0·002 per cent. Pinosylvin monomethyl ether, although extremely toxic to *Coniophora puteana* and *Merulius lacrymans*, was only slightly toxic to the others. [Cf. *For. Abstr.* 7 (No. 1819).]

[305]. 31.42.12. Le bleuissement du bois des résineux. **[Blue-stain of softwoods.]** *Ann. Éc. Eaux For. Nancy* 8 (1), 1941 (109–15). [F.]

A general account of blue-stain in softwoods. The comparative harmlessness of the fungi is emphasized; the extension of the stain ceases when the moisture content of the wood falls below 30 per cent. and prompt seasoning of converted timber is the best preventive measure. [Cf. *For. Abstr.* 8 (Nos. 330, 460).]

31.43. Attack by Animal Organisms

[306]. 31.43 : 32.22 : 12.26–8 : 13.2 : 12.11.11 : 31.3 (943). BRIMBLECOMBE, A. R. **Investigations on starch in living trees of Queensland timber species in relation to control of the powder post beetle.** *Aust. Timb. J.* 11 (8), 1945 (365–6, 369, 371, 373, 375, 377, 388).

Investigations and experiments were made on some timber species of Queensland with the object of determining and reducing their starch content so as to render them immune to *Lyctus brunneus* attack. Investigations into the distribution and seasonal variations of the starch content in Lemon Scented Gum (*Eucalyptus citriodora*), Spotted Gum (*E. maculata*), Red Tulip Oak (*Tarrietia peralata*) and 13 other hardwoods showed that starch content was not normally reduced to immunity level by natural means and that no satisfactory depletion by resorption took place in logs with bark on after felling. Light ring-barking at the top of the commercial bole, however, produced complete immunity in Lemon Scented Gum and Spotted Gum in 6 and 8 months respectively, and in Red Tulip Oak, with a few exceptions, in 12 months. Climbing with spurs and body belt and using a light short-handled axe, one man can ring 10 Red Tulip Oak or over 20 Spotted Gum in a day. Cost of treatment is put at sixpence per 100 super ft. for total wood, or 9*d.* to 4*s.* based on sapwood only. [Cf. *For. Abstr.* 7 (No. 1930); 8 (No. 461).]

31.45. Injury by Fire

[307]. 31.45. Condon, E. U. **The self-ignition temperature of partially charred wood.** U.S. National Bureau of Standards, Washington, D.C. 1945. pp. 6 + figs.

Specimens of Maple (uncharred) and Maple, Red Pine, White Pine and Douglas Fir (partially charred) were subjected to the ignition test of the U.S. National Bureau of Standards, the self-ignition temperature being defined as the minimum temperature at or above which the material, after a short period of self-heating, passes into a condition of observable combustion without the presence of any extraneous source of ignition.

The test procedure is described. The self-ignition of the specimen was preceded by a rapid rise in temperature above 450° C. Some of the non-ignition reactions were also characterized by a rapid rise in temperature of the specimen, but without attaining temperatures over 400° C., and followed by a rapid fall. It was observed that the shape of the specimen and the length of exposed fibres had a considerable effect on the self-ignition temperature, the lowest self-ignition temperatures for all types of wood being obtained with small chips and sawdust, or with a solid block with small grooves made across the fibres in order to expose short lengths of the wood.

Results are given in the report with temperature curves for some of the tests. A comparison is made of the self-ignition temperatures of charred and uncharred wood. The charred wood ignited at somewhat lower temperatures, but it is thought that the relation might have been modified if the charring had been carried further to the formation of material approaching charcoal.

31.8. *Defects of Timber*

See also *For. Abstr.* 8 (Nos. 592–3, 657).

[308]. 31.8 : 12.11 : 12.14.4. Jacobs, M. R. **The growth stresses of woody stems.** *Bull. For. Bur. Aust.* No. 28, 1945. pp. 67.

The stresses that develop in the woody tissues of trees as they grow (growth stresses) were investigated by measuring the strains in green stems, comparing the in-stem and out-of-stem dimensions of selected pieces, and estimating the stresses from these strains by the use of appropriate factors.

The outer layers of erect hardwood stems of all sizes were found to be in tension longitudinally and the inner layers in longitudinal compression, a strain gradient showing a progressive longitudinal compression from periphery towards the pith always being found. After a young hardwood shoot completes expansion from the bud, subsequent growth in diameter is accompanied by a progressive shortening of the distance between any two points on the longitudinal axis. The stress equivalent of the consequent compression of the older layers in a large stem is a considerable force. Longitudinal compressions having stress equivalents of at least 100 atmospheres were found near the pith of stems larger than 3 in. in diameter. Two opposing factors were observed in erect coniferous stems. In small stems there is a tendency for the outer layer to be in compression and the inner layers in tension; in larger erect stems the outer layers are nearly always in tension, as with hardwoods, and the inner layers tend to be compressed. After a coniferous stem makes its initial rapid expansion from the bud, it continues to extend in length very slightly for a few years. Beyond a certain age, diameter growth is accompanied by a shortening of the longitudinal axis, as in hardwoods.

The results of the studies suggest that the recovery of leaning stems is associated with a modification of the strain gradients found in vertical stems, as well as with special forces developed in leaning shoots.

As regards lateral stresses, the tissues of all stems tested were found to be tangentially compressed near the periphery, and in radial tension near the pith. The nature of the strain gradients found in all stems suggests that the primary growth stresses are developed in successive sheaths of new wood as it is formed. The strains found in the inner layers are reactions to these primary stresses.

Various factors which may contribute to the primary growth stresses were examined during the investigation, and certain hypotheses are put forward, notably that sapstream tension is the cause of longitudinal stresses of erect hardwood stems and larger coniferous stems. The strain pattern in an erect green stem of some size is at first sight rather complex. The cambial zone is pushing the bark outwards and is thus in radial compression with the bark in tangential tension. The outer woody layers are in longitudinal tension and tangential compression, while the inner woody layers are in longitudinal compression and radial tension. If the sap-tension hypothesis as to the origin of the longitudinal forces is the correct explanation, the strain pattern is not quite so complicated, for it will be the sap, not the wood, that will be in longitudinal tension in the outside layers of trees. The woody substance will be in progressive compression from the outside inwards.

The investigation showed that the variable movements of planks being sawn from a flitch are clarified by a knowledge of the position of the plank and the flitch relative to the strain gradient of the log as a whole.

The possible effect of growth stresses on certain defects in timber and growth processes are also discussed in the paper. *From author's summary.*

[309]. 31.8 : 12.26–8 : 42.21 : 31.1. LARSEN, P. Vinterkuldens Betydning for Kernedannelse hos Bøg. **[The significance of winter cold in relation to heartwood formation in Beech.]** *Dansk Skovforen. Tidsskr.* 28 (4), 1943 (141–57). [Dan.]

Cf. *For. Abstr.* 5 (257). The unusual features following the severe frosts of 1941–42 were (i) the suddenness of the appearance of heartwood; (ii) the large number of trees affected; (iii) the development of heartwood in trees only 40–60 years old; (iv) the large diameter of the heartwood, its dark or greyish colour and the absence in it of the successive boundary lines characteristic of red heartwood. Microscopic examination showed that the differences between the frosted and red heartwood were quantitative ones only, viz., the former had fewer, less markedly yellow-brown tyloses and lighter-coloured heartwood deposits with less tendency to aggregation. Though, in the author's opinion, the primary cause of red heartwood in Beech is some kind of physiological injury and not fungus attack, it is still uncertain whether this cause is normally frost injury. Nevertheless, previous workers emphasize that after some years it becomes difficult or impossible to distinguish between frosted and red heartwood, and it is probable that with time the former passes into the latter condition.

A review is made of the damage in Denmark by districts and notes are included from literature on the technological properties of frost-heart with particular reference to preservative treatment. [Cf. *For. Abstr.* 7 (No. 1818).]

[310]. 31.8 : 12.26–8 : 24.2. LARSEN, P. Undersøgelser over Dannelsen og Væksten af Rødkerne hos Bøg. **[Studies on the formation and development of red heartwood in Beech.]** *Dansk Skovforen. Tidsskr.* 28 (10), 1943 (437–74). [Dan.dan.] MØLLER, C. M. Bøgens Rødkernedannelse og Udhugningsstyrken. **[The formation of red heartwood of Beech and thinning grades.]** *Dansk Skovforen. Tidsskr.* 28 (12), 1943 (555–7). [Dan.] LARSEN, P. Rødkerne og Udhugning. **[Red heartwood and thinning.]** *Dansk Skovforen. Tidsskr.* 28 (12), 1943 (558–9). [Dan.]

Increment cores were taken from Beech stands in different parts of Denmark to determine the diameter increment of red heartwood present at the beginning of the study, the number of trees that were then free from this defect but subsequently acquired it, and the growth of red heartwood during the period of study. For the 3–4 years of the study, red heartwood initially present put on an average diameter increment of 3·5 mm. annually. A comparison with age and diameter figures showed that the previous diameter increment of the red heartwood in these trees had been 2·8–3·2 mm. per annum. In trees of equal age, the percentage volume of red heartwood was greatest in those of the greatest diameter; in trees of equal diameter it was greatest in those of the greatest age: hence the volume of red heartwood increases with both age and diameter. The number of trees developing the defect during the study was greatest in places where there had previously been most red heartwood. There was no definite indication that the growth or acquisition of red heartwood was influenced by thinning grades. On the whole, the percentage of redhearted trees increased with both age and mean diameter of the stand, though the material did not allow of any conclusions on the reciprocal effects of these factors. Trees having red heartwood at the beginning of the study had the greatest average diameters. It was not possible to demonstrate any connexion between the acquisition of red heartwood and the form or position of the trees so affected. The practical conclusion from these findings is that measures should aim at producing timber of the desired diameter at as early an age as possible, in order that red heartwood, if present, should be as small in volume as possible.

C. M. Møller, in comment, questions the conclusion that thinning grades had no demonstrable effect on the growth of red heartwood and emphasizes the implication that if for a given tree diameter the diameter of the red heartwood is smaller at the lower ages, then logs from a heavily thinned stand will be younger and contain less red heartwood than those from a lightly thinned stand of the same mean diameter. Variations in site quality could not be sufficient to account for the differences in question.

Larsen, in reply, admits that Møller's interpretation may well be correct, but repeats that for the period of the study it was not possible to obtain direct evidence on this point.

[311]. 31.8 : 31.43 : 12.26–8. Campbell, W. G., Packman, D. F., and Rolfe, D. M. **The composition and origin of a white deposit found in galleries of a wood boring insect in two samples of the wood of *Qualea* sp.** *Emp. For. J.* 24(2), 1945 (232–3 + plate). [Forest Products Research Laboratory, Princes Risborough.]

Two samples of *Qualea* of South American origin contained a hard, white deposit which had been laid down in galleries of a wood-borer (probably a cerambycid) and was also present in pores and fissures in areas not directly connected with the galleries. The white material was found to be relatively free from particles of wood or other organic material; it was very sparingly soluble in water and acids, but completely soluble in alkali. Qualitative analysis suggested that it was an organic substance of high ash content. The only metal identified in either the substance itself or the ash remaining after ignition, was aluminium. No inorganic acidic radicals were identified and the only organic acid found to be present in combination with the aluminium was succinic acid. The high proportion of ash remaining after ignition at 900° C. (26·20 per cent.) indicates that in addition to aluminium succinate, the deposit must contain some substance or substances of high aluminium content. This condition would be met by basic aluminium succinate.

There is little doubt that the deposit originated as a result of a flow of tree sap into the cavities created by the borer, followed by evaporation of water, and the same phenomenon could presumably have taken place in cavities formed in sapwood by other agencies. Succinic and related acids are known to be of frequent occurrence in the sap of trees. Aluminium is also frequently present, but in very small amounts.

The other tree species in which a deposit containing aluminium succinate has been recorded is *Orites excelsa*, one of the many Australian trees known as Silky Oak.

32. HARVESTING OF WOOD. LOGGING

[312]. 32 (410) : 07.7. Urquhart, B. P. **Experiences in harvesting timber and their application to silviculture and management.** *Forestry* 19, 1945 (113–27 + plates).

The article describes a variety of methods of harvesting timber during the war, in which many types of mechanical plant comparatively new to British practice have been used. The merits and demerits of plant and methods are discussed and an attempt made to assess how far they may be applied to future operations in British woodlands. It is considered that conversion of smaller logs in the woods by co-operatively owned, portable sawmills is necessary in order to maintain economic forestry in Great Britain. The equipment recommended includes the crawler tractor with winch, and the diesel-engined truck on a short wheel-base with an auxiliary front-wheel drive. It is suggested that the difficulties of extracting thinnings economically might be reduced by wide planting every 50 yards or so, and the use of ponies or light horses for hauling poles on steep rocky slopes.

[313]. 32 (44 : 493) : 33.17 : 07.7. Lloyd, A. H. **Timber supplies for the Allied Expeditionary Force, 1944–45.** *Emp. For. J* 24 (2), 1945 (141–9 + plates).

The supply of timber to the B.E.F. in France and Belgium in 1939–40, and the subsequent forestry operations by Military Units in Great Britain, were described in a previous article [see *For. Abstr.* 6 (171)]. The present article deals on the same lines with the period from the Normandy landings on 'D' Day until July, 1945, when the planning of timber procurement was handed over to the Allied Control Commissions for Germany.

[314]. 32 (728.2) : 12.26–8. Markham, W. A. **Mahogany logging in British Honduras.** *Timberman* 46 (12), 1944–45 (52–4, 56, 58). [Weis-Fricker Mahogany Company, Belize, British Honduras.]

Mahogany logging in British Honduras suffers from lack of proper equipment. Trees are felled by men working alone, using pole axes, and are cross-cut by two men using saws from 8 to 10 ft. long. There are few streams suitable for floating logs. Trucks and trailers are gradually coming into use and during 2 to 4 months in the dry season hauling can be done over earth roads. Most of the Mahogany logs are still hauled to their destination by tractors and 8-wheeled wagons. The writer emphasizes the poor quality and small amount of mechanical equipment available.

[315]. 32 : 07.7. Simmons, F. C. **Recent developments in logging in the Northeast.** *For. Prod. Pap. Ntheast. For. Exp. Sta.* No. 7, 1946. pp. 13 + figs. P.R.

A paper originally prepared for the Maine Hardwood Lumbermen's Association and dealing with the training and equipment of woods workers. Brief illustrated descriptions of logging, bucking and loading equipments and of a log-barker and circular semi-portable cutting-up plant are given.

32.1. *Marking of Trees and Coupes*

[316]. 32.1 : 07.7. Nyt Ridsejern. **[New tree scribe.]** *Dansk Skovforen. Tidsskr.* 29 (2), 1941 (56). [Dan.]

The scribe (figured), invented by O. Løwe, consists of a wooden grip, a leather guard, and an iron bow to which the actual cutter is attached by a thumbscrew. When not in use, the cutter pivots so as to rest in a notch in the iron bow. Three sizes of cutter are supplied with each scribe. Practical tests have shown the utility of this tool, particularly that of the leather handguard.

32.2. *Felling and Related Operations*

[317]. 32.25 : 07.7. Pond, T. M. **Consumption of cutting tools.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 814 (B–7–b), 1945. pp. 4.

The material presented in this paper was compiled from replies to a questionnaire, received from 21 companies.

Tool consumption per 1,000 cords pulpwood cut

Type of tool	*Consumption per 1,000 cords cut*
Axe handles	37·9
Axe heads . .	16·7
Webb saw frames .	6·87
Webb saw blades .	44·6

[318]. 32.25 : 07.7. Sulimov, A. N. Uluchshennaya pravka luchkovȳkh pil. **[Improved doctoring of bow-saws.]** *Lesnaya Prom.* No. 5/6, 1945 (8–10). [Russ.]

In comparative tests of cross-cutting with bow-saws, using a 'dynamograph' apparatus to record the actual work done, it was found that; (1) For saws with a medium-hard carbon-steel blade, the best results in cutting moist and half-dry timber were obtained when the teeth were filed to a honing angle of 35°, which reduced the work done (per sq. cm. of section cut) by 17·5 per cent. compared with an angle of 45°.

(2) The planing teeth in this type of saw should be lowered not less than 1–1·2 mm., the expenditure of work then being 15–30 per cent. less than with planing teeth lowered by 0·5–0·7 mm. As it appeared that the optimum had not been reached with reduction by 1·2 mm., the advantage of having any planing teeth in such saws is open to question, especially as they require more skilled filers for maintenance. (3) Reduction of the cutting teeth from 7 to about 5 mm. in height is recommended as giving 12 per cent. less work per unit of section cut, and this reduction is particularly desirable when hard and frozen timber is to be cut. (4) 11–14 per cent. less work is required if the cutting teeth are set for only half of their height instead of for their whole height. (5) Warping of the blade seriously affects sawing efficiency and proper hammering is essential.

[319]. 32.25 : 07.7. ARTMAN, J. O. **Log production by chain and crosscut saws.** *J. For.* 44 (4), 1946 (289–90). [Department of Forestry Relations, Tennessee Valley Authority, Norris, Tenn.]

The T.V.A. Department of Forestry Relations is comparing the productive capacity of the power chain saw with that of the cross-cut saw. A Mall saw with a 5-h.p. petrol engine and a 36-inch cutting bar produced hardwood sawlogs in about one-half the time required by the cross-cut saw, and at two-thirds or less of the cost. Cutting was done in an old-growth upland hardwood stand with trees ranging from 9 in. to 32 in. d.b.h. The volume removed was about 11,500 bd. ft. per acre. Slope varied from 0 to 20 per cent. and averaged 5–10 per cent. The chain-saw crew consisted of four men, untrained except for rudimentary coaching on how to start and operate the saw; the cross-cut crew contained two men who followed conventional timber-cutting practices.

[320]. 32.25 : 07.7 : 82. WIESEHUEGEL, E.G. **Power chain saws and manual crosscut saws in the production of hardwood logs.** *Sth. Lumberm.* 172 (2155), 1946 (46–50).

A series of studies is being conducted by the Department of Forestry Relations of the Tennessee Valley Authority on the comparative productive capacity of a power chain saw and the cross-cut saw for felling and cross-cutting timber in the woods. This report covers the first phase of the enquiry and presents a comparison of the two saws in the production of hardwood sawlogs on moderate slopes. The results indicate that the chain saw will produce Oak and Hickory sawlogs with about half the man-hours required by the cross-cut saw and at two-thirds or less of the cost. It was found that in trees of 14 in. d.b.h. the chain saw timber-cutting cost is $2·01 per 1,000 bd. ft. compared with $3·55 by the cross-cut. In 24-in. trees the respective costs are $1·23 and $2·16, and in 32-in. trees $1·02 and $1·79. The output of a chain saw with a crew of 4 is almost double that of two cross-cut saws manned by 2 men each. In smaller diameters, chain-saw cross-cutting is complicated by difficulty with pinching. A remedy for this may be removal of branches and top first, and then cutting logs from top towards butt. Much further study is needed on size of crew and organization of work in relation to size, character, and volume of timber being removed.

[321]. 32.25 : 07.7. TOLES, G. **Pulpwood cutting by the portable engine-driven chain saw.** *Sth. Pulp Paper J.* 8 (6), 1945 (41).

The power chain saw, a travelling chain with saw teeth which is linked to a power unit, is now free from sale restrictions. The author is of the opinion that the extended use of this saw will greatly increase the speed of pulpwood production and will solve problems of man-power shortage.

[322]. 32.25 : 07.7. CHALLENGER, J. W. **Power saws—past, present and future.** *B.C. Lumberm.* 30 (2), 1946 (86, 90, 92, 94, 96).

An account of the development and use of power saws for felling and cross-cutting, particularly in British Columbia.

[323]. 32.25 : 07.7. **New type power saw announced.** *Timberman* 47 (4), 1945–46 (90).

A new type of power saw (the Sally saw) has been designed by the Cummings Machine Works of Boston, Mass., for quicker and easier production of pulpwood and small logs. The unit weighs 69 lb. and is driven by an air-cooled 1½-h.p., 4-cycle engine. The specially designed circular saw blade, operated by a shaft through driving gears, has no central hub, so that the blade can saw all the way through a tree of 11 in. diameter without notching, and one of 16 in. diameter by going round the trunk. The saw can be removed in less than a minute.

[324]. 32.25 : 07.7. Patsiora, P. P. Oblegchennye elektropily i elektrostantsii. **[Improved electric saws and [lay-out of cables with mobile] power generators.]** *Lesnaya Prom.* No. 1/2, 1945 (11–4). [Russ.]

Illustrated specifications for two types of electric chain saw, designed for felling and cross-cutting and officially approved for production.

(*a*) Kharlamov's one-man saw, with a tubular (oval-section) steel bow frame. The motor, an asynchronous, short-circuit closed type, operating at 120/220 volts and 0·8 kw. (3-phase current; 50 cycles) and giving 3,000 revs. per min., is mounted at right angles to the chain track, the driving cog being attached directly to the axis of the rotor, at the other end of which is an 8-vaned fan for ventilation. A handle with switch is attached to the housing of the fan. The body carrying the chain track is held rigid by the tension of the bow. A screw adjustment is provided for tensioning the chain by moving the idle cog in a slotted housing. Each link of the chain has 2 cutting teeth and 1 planing tooth, the kerf being 4 mm., maximum diameter of cut 50 cm., and rate of cutting 9–10 m. per sec. The total weight is 12 kg.

(*b*) Type Vakopp-1, a two-man bowless saw. The motor, of a type similar to Kharlamov's, operates at the same voltage and revs. per min. but has a power consumption (3-phase current; 100 cycles) of 1·2 kw., and is mounted in line with the chain track, the drive being transmitted by conical pinions giving a gearing of 1 : 2. There are 3 handles: one with switch attached to the ventilator housing, a second (in the form of a circle acting as a rest (but partly cut away to allow of felling with especially low stumps) fixed to the gear housing, and a third at the same end as the idle cog. The body carrying the chain track is of sheet steel, and is cut away for lightness. Chain tension is adjusted by a screw-and-spring device for moving the driving cog. The chain is a standard type. The kerf is 8 mm., the maximum diameter of cut 50 cm., rate of cutting 5–6 m. per sec., and total weight 17 kg.

Some notes are also included on cable and cable connectors and the lay-out of cables for simultaneous operation of several saws from one power unit [cf. following abstract].

[325]. 32.25 : 07.7. Epifanov, B. I., and Gorbachevski, V. A. Elektrostantsiya dlya elektropil. **[[Mobile] power generator for electric saws.]** *Lesnaya Prom.* No. 1/2, 1945 (19–22). [Russ.]

The Vakopp-1 two-man electric saw is said to have test performances of 120 cu.m. in felling, and 96 cu.m. in cross-cutting, per [? 8-hour] shift, corresponding figures for Kharlamov's one-man electric saw being 70 and 64 cu.m. respectively [cf. preceding abstract]. The question of power supply for such saws is briefly examined and it is concluded that to every 4–5 saws a power unit developing at least 11–12 kw. would be necessary and that this should be mounted on a special self-propelling caterpillar tractor. A draft design for a producer-gas tractor and power unit suitable for this purpose is described and illustrated. Standard components are specified and the use of these should mean rapid and cheap construction.

[326]. 32.29.1 : 07.7 : 44.3 : 45.3 : 11.4 : 76 : 34.6 : 53.31. Moltesen Nielsen, P. Stødrydning. **[Stump-grubbing.]** *Dansk Skovoren. Tidsskr.* 25 (5), 1940 (181–220). [Dan.]

A review of literature (67 refs.), mainly German, under the headings: object; properties of stumpwood; solid volume of stumpwood; methods, including grubbing by hand, machine, blasting, and pulling whole trees over complete with roots; uses of stumpwood; influence on pests, diseases, and the soil; and profitableness of the operations.

[327]. 32.29.1. Vestergaard, N. Aerolit-Sprængning af Stubbe. **[Stump blasting with Aerolit.]** *Dansk Skovforen. Tidsskr.* 25 (10), 1940 (530–6). [Dan.]

[328]. 32.29.2 : 07.7 (73). Colvill, L. L. **Development and use of Forest Service slashbuncher teeth.** *J. For.* 44 (2), 1946 (89–91). [U.S. Forest Service, Portland, Ore.]

The need for mechanization of slash disposal as a result of wartime accelerated cutting and shortage of labour led to the development of the removable slashbuncher teeth for attachment to an ordinary bulldozer blade, which are described in this article. The cost of the teeth constructed in the Forest Service shop averaged $175 per set for a size 30 tractor and $225 per set for a D-8 size tractor. Cost of operation per acre varies with the skill of the operator and the conditions in the forest. Under most favourable conditions the cost averaged $8 per acre; with less favourable conditions $14 per acre.

[329]. 32.29.2 : 07.7 (79.7). WEAVER, H. **Slash disposal on the Colville Indian Reservation.** *J. For.* 44 (2), 1946 (81–8). [Colville Indian Reservation, Nespelem, Wash.]

Tractor piling and burning of slash gave excellent results for a moderate cost in trials on the Colville Indian Reservation and could probably have a wider application in the Ponderosa Pine region. This method involves the piling of logging slash by tractors so that it can later be burned during periods of favourable weather in autumn or spring. For such work, tractors must be equipped with a special slash piler, consisting of a number of heavy teeth designed to rake the ground free of limbs, etc., and with a brush rack to prevent this material from rolling back on to the tractor or driver. The method can be used to good advantage on flat ground and gentle to moderate slopes. Controlled spot burning also gave good results; it requires just the right weather and great care, but can be used to advantage on steep slopes and rocky areas where tractor piling is impracticable.

The tests were made in 1944 and it is already clear that the more intensive use of controlled fire has resulted in silvicultural benefit to the reserve stand and advance reproduction [cf. *For. Abstr.* 5 (32); 8 (Nos. 207, 664)].

32.8. *Storage of Wood in the Rough*

[330]. 32.82 : 33.36.1 : 31.42.12 : 31.43 : 12.25. BUTOVITSCH, V., and NENZELL, G. Praktiska råd och anvisningar vid tillvaratagande av vindfällt och brandskadat virke. **[Practical advice and instructions on the treatment of windthrown and fire-damaged timber.]** Svenska Skogsvårdsföreningen and Norrlands Skogsvårdsförbund. A.-B. Fahlcrantz' Boktryckeri, Stockholm. 2nd ed., 1943. pp. 52. [Sw.]

This illustrated booklet contains practical recommendations, based largely on the papers noted in *For. Abstr.* 1 (278) and 5 (235, 259), for the protection of timber stored for the summer before extraction, against blue-stain fungi, with particular reference to control of their insect vectors, which are responsible for far more blueing than that occurring directly on exposed wood surfaces.

Section A summarizes storage methods in general: (i) *For windthrown timber*, which should be stored if possible without barking, protective measures being taken only for the more valuable material. Water storage, where possible, affords good protection to both barked and unbarked logs, even if insect attack has already begun in the latter instance. Storage in trenches about 40 cm. deep in wet peatland also gives adequate protection provided that the stacks are covered on all sides with turves or *Sphagnum* moss in a layer 20–30 cm. deep. For drier sites the recommendations are: (*a*) Unbarked timber felled after the swarming of insect vectors of stain should be skidded with as little injury as possible and made up into stacks scrupulously covered on all sides with 20–30 cm. of peat-moss or grass turves. (*b*) Unbarked logs felled before the swarming period are more difficult to protect. Covering as in (*a*) and the use of trap logs of low quality, left about in the neighbourhood of the stacks (and completely barked before the insects complete their development therein) will give a fair degree of protection, but for fully satisfactory results the logs should be sprayed before the swarming period with a zinc-arsenate preparation (preferably 750 g. zinc arsenate mixed with 300 g. freshly slaked lime with enough water to make a thin cream, added to a solution of 600 g. soda and made up with water to 15 l.). This spray should be applied only to the bark, as it is designed simply to prevent insect attack and appears to stimulate growth of the blueing fungi on exposed wood surfaces. A covering as in (*a*) is provided after spraying. (*c*) Barked timber cannot be protected merely by covering but must be sprayed first with fungicidal preparations containing ethyl mercuric chloride, e.g. 1-per-cent. Lignasan or Pulpasan [cf. later paper referenced in *For. Abstr.* 7 (No. 1249)], then stacked with bottom and outer layers of untreated low-grade logs and covered in the usual manner. It should be noted that where peat, moss, or grass turves are not readily available, stacks of barked or unbarked timber can be covered with tar-impregnated paper and only the ends of the stacks covered in with moss and slash or the like. (*d*) If less than half of the root system has been torn up, Pine windthrows on moist sites may be left as they are with little fear of attack; on dry sites or with further weakening of the tree, insect and blue-stain attack will develop.

(ii) *For fire-damaged timber*, whether standing or felled, it is a general rule that the later the occurrence of the fire in the growing season, the less is the liability to insect attack and blue-stain. Water storage is recommended where possible. For land storage the logs must be completely barked to control beetles such as *Monochamus sutor*, and are then treated as other barked logs.

Section B is devoted to detailed advice on the storage of Pine timber, for which it is of first importance that treatment should be done as soon as possible in spring and completed as rapidly as possible owing to the early swarming of the Pine beetles carrying blue-stain, under the headings: autumn work (planning of skidding and stacking) and spring work (including notes on sprayers and sprays, labour, precautions with poisons, preparation of the spray for unbarked logs, spraying technique, stacking and covering). The principles in this and the succeeding sections are as summarized in Section A. Unbarked Spruce logs (Section C) are easier to protect than Pine, owing mainly to their smoother bark and the longer time available for operations, as the chief vector of blue-stain, *Ips typographus*, does not swarm until late May or early June. Where unbarked Pine and Spruce (Section D) occur on the same site, convenience may decide whether separate or mixed stacks shall be made, but in the latter case the treatment must be timed to suit the Pine. Section E contains supplementary notes on the storage of barked timber.

A list is given of firms supplying chemicals and sprayers and an appendix briefly describes the characters and life history of the chief insect vectors of blue-stain in Sweden, viz. for Pine—*Blastophagus* (*Myelophilus*) *piniperda*, *B. minor*, *Ips acuminatus*, and *Monochamus sutor*; and for Spruce—*Ips typographus*. [Cf. *For. Abstr.* 8 (No. 305).]

[331]. 32.82 : 33.32 : 33.36.2 : 31.42.11 : 12.25. Björkman, E. Om lagringsröta i massavedgårdar och dess förebyggande. **[On storage decay in pulpwood yards and its prevention.]** *Medd. Skogsforskningsinst.* [*Skogsförsöksanst.*] *Stockh.* 35 (1), 1946 (1–174). [Sw.sw.e.]

The commonest decay fungus of stored Pine and Spruce pulpwood was *Stereum sanguinolentum*; *Polyporus abietinus*, with its variant '*Irpex fuscoviolaceus*', and *Corticium evolvens* were also very common. Under suitable storage conditions these and similar fungi, which consume mainly lignin, appear early and cause 'early rot'. 'Late rot' of pulpwood stored longer under unfavourable conditions is caused by *Poria vaporaria*, *Trametes serialis*, *T. trabea*, *Lenzites sepiaria* et al., which are mainly cellulose destroyers and cause considerably greater damage than the early-rot fungi. In all, over 1,000 mycelia, belonging to at least 40 species, were cultivated from infected logs. Data were collected on the micro-climate of pulpwood stacks and on the influence of barking; in the latter instance decay was found to be much greater in unbarked and partially barked than in completely barked wood, usually being most severe in the bottom layer of stacks, especially if no special stack foundation had been used. Data from sulphite and sulphate cooking tests are also furnished to indicate the deterioration in yield and quality of pulp due to storage decay by different fungi over various periods, and an account is given of laboratory experiments to determine the most favourable conditions of temperature and moisture for early- and late-rot fungi. In the latter experiments no general difference could be shown between Pine and Spruce sapwood in susceptibility to decay, and wood with broad annual rings suffered losses of weight hardly greater than those of narrow-ringed wood; as regards colour changes, however, storage decay is probably more serious in the broad-ringed sulphite wood, as it is known that hyphae penetrate wood of this type more easily.

Practical recommendations from the findings are: (i) In upper Norrland pulpwood can be stored in calm water for one summer and autumn without serious decay, but farther south the risk of decay is considerably greater for water storage over such a period. (ii) In land storage the aim should be to secure conditions as dry as possible. Pulpwood should be stacked completely barked, in well ventilated stacks raised on special foundations to secure ventilation beneath. High stacks of floated wood should be spaced at least 3 m. apart; lower stacks and those of land-transported timber may have a closer spacing. Stacks only one log broad are to be preferred. (iii) Yards should be situated on sloping ground if possible, but on flat ground some improvement can be attained by surfacing the yard with cinders, shingle, sand, etc. (iv) Stacks should be laid out in the direction of prevailing winds and the spaces between them kept clear. (v) To secure effective and even drying, the period April—June should be used to the greatest possible extent for drying the lower layers of stacks, e.g. high stacks of floated timber may be piled in spring to only half their final height, which may be made up in the latter part of summer. Stack building may also be similarly staggered between autumn and spring. Where practicable, alternate stacks might be built at different times, or other special measures for good ventilation taken according to local conditions. (vi) Pulpwood of different quality, e.g. as regards rate of growth, density, decay damage, etc., should be separated if possible into different stacks, and if storage for more than one year is envisaged, winter- and summer-felled wood should also be separated, as it has been shown that even inconsiderable damage, which always occurs in summer-felled wood left to dry in the forest, will much more easily develop further in both very moist and relatively dry wood than will damage caused by the same storage conditions in winter-felled wood, which is not already so seriously infected before being stacked. (vii) Proper sanitary measures should be taken in the yards, e.g. bark debris and decayed wood should be removed, permanent wooden foundations for stacks should be impregnated, piles of fuelwood, which is often badly decayed, should be at some distance from stacks of first-class pulpwood, etc. As, however, all wood arriving at the yard is already likely to be infected to some extent, these measures can only supplement those taken to achieve good ventilation and drying.

[332]. 32.82 : 33.36.1 : 12.26–8. Møller, C. M., and Hermann, P. Forsøg med Konservering af vinterfældede Bøgekævler til Opskæring gennem Sommeren. **[Experiments on the preservation of winter-felled Beech logs for conversion during the summer.]** *Dansk Skovforen. Tidsskr.* 26 (10), 1941 (337–64). [Dan.]

After preliminary laboratory tests (tabulated) of various end coatings with and without added preservatives, field tests were made to compare Kævlefedt ('log grease'—a coating preparation of unspecified composition, produced by A/S Junckers Savværk, Køge—alone or with the addition of 3 per cent. of NaF or 10 per cent. of Carbolineum) with Lignosith (a coating produced by I.G. Farbenindustrie), and to determine, for logs treated with Kævlefedt and untreated controls, the effects of time between felling and end coating, storage in the woods versus storage at roadside, age of trees furnishing the logs, and treatment with standard preservatives (creosote, mercuric chloride, sodium fluoride) before coating. Results: (i) Kævlefedt (alone) and Lignosith were about equally effective but the latter can be applied cold and is easier to spread. Addition of either NaF or Carbolineum decreased the effectiveness of Kævlefedt. (ii) There was little difference in results for logs end-coated with Kævlefedt at times varied up to 5 weeks after felling, though adherence was somewhat poorer with applications made within the first week. Frost sometimes caused lifting of the coating. (iii) There was little difference between storage in the woods and at the roadside; treated logs skidded to the roadside were slightly more susceptible to fungus attack. (iv) Wood from older trees showed rather less fungus attack, probably owing to the prevalence of red heartwood. (v) Pre-treatment with standard preservatives, especially Carbolineum, appeared to have a slight favourable effect. From these results and those of a questionnaire, which suggest that no considerable fungus damage occurs in Beech logs before 1st June, it is concluded that (*a*) no treatment should be applied before the end of the winter frosts; (*b*) thereafter, all logs currently cut, and as many of those previously cut as required by the mills, should be end-coated, splinters at the butt first being cut off; (*c*) treatment should never be done in frost or on too freshly cut timber; (*d*) the coating should be about 1 mm. thick, and wounds as well as top and butt ends should be treated; (*e*) owing to the ease of handling, Lignosith is to be preferred to Kævlefedt if obtainable at the same price; Kævlefedt may need warming or thinning with benzine before use; (*f*) storage in the woods is probably slightly better than at the roadside. Further work is desirable on the value of pre-treatment with preservatives.

32.9. *Transport*

[333]. 32.91 (485) : 82 : 07.7 : 38.3. Flodman, B. Rationalisering och rationaliseringsmöjligheter vid virkestransport med häst. **[Rationalization and its possibilities in**

horse-drawn timber transport.] *Svenska SkogsvFören. Tidskr.* 41 (3), 1943 (243–80). [Sw.]

The object of this paper is to indicate the need for detailed research on the whole complex of problems involved in timber extraction and transport, with particular reference to horse transport. To this end a review is made of (*a*) the different operations involved, with some figures from preliminary time studies; (*b*) implements (chiefly types of timber sledges) used in these operations; (*c*) types of road, with particular reference to snow and ice roads, including a review of some Finnish work on the properties of snow and ice; and (*d*) the horse as the source of draught power, with emphasis on the need for selection of suitable breeds and their improvement by further breeding, the possibilities of objective testing of horses by dynamometers with simultaneous measurement of physiological responses, and for studies and instruction in the care of horses. A further problem will be the training of a body of efficient supervisors and foremen.

[334]. 32.91.1 : 32.25. Germanov, V. G. Potochnȳ sposob lesozagotovok. **[A 'continuous' method of felling and extraction.]** *Lesnaya Prom.* No. 5/6. 1945 (5–6). [Russ.]

The method, applicable only to clear fellings, consists in felling so that the logs lie, parallel to the extraction road and with their butts towards the direction of extraction, on previously prepared rough rails made with long logs well trimmed and barked on their upper surface, on which the timber is rolled out direct to a snow road where further transport is done with motor vehicles. Up to a distance of about 50 m. rolling is done manually; beyond this point, by horses. Where a motor derrick is available, logs may be hauled in from a distance of about 40 m. When all available logs have been removed in this manner, the rail logs are taken up, cross-cut to size, and rolled out, beginning with those farthest from the road, so that the site is progressively cleared of all merchantable material.

[335]. 32.91.12 : 07.7. Pantser, A. V. Trelevochnȳ traktor konstruktsii TsKB Narkomlesa SSSR. **[A skidding tractor designed by the Central Construction Bureau of Narkomles.]** *Lesnaya Prom.* No. 1/2, 1945 (15–9). [Russ.]

An illustrated specification of a producer-gas caterpillar tractor (a modification of the type KhTZ–T2G) designed by the Central Constructional Bureau of Narkomles for work in the forests the year round. The clearance is 500 mm., track pressure 0·31 kg. per sq. cm., and a special winch with a tractive power of 2,000 kg. is fitted. The test model was practically completed at the time of writing.

[336]. 32.91.2 : 07.7 : 38.3. Toropin, D. K. Bestrelevochnaya vȳvozka avtomashinami neposredstvenno s paseki na nizhnie skladȳ. **[Extraction by motor, without skidding, direct from felling site to main timber depot.]** *Lesnaya Prom.* No. 5/6, 1945 (6–8). [Russ.]

Notes on the transport of short logs direct from felling site to timber depot with the aid of caterpillar tractors, with chief reference to (and with diagrams of) the type of sledge used and summer extraction roads having ruts with a stone-and-gravel or a brushwood-and-gravel filling.

[337]. 32.91.22 : 32.96. Kjellberg, G. Lastning av timmer i storlass. **[Loading of timber [for sledge haulage] in large loads.]** *Svenska SkogsvFören. Tidskr.* 42 (4), 1944 (292–305). [Sw.]

In northern Sweden, particularly in Norrbotten and Västerbotten, it is now not uncommon for loads of 300–400 cu. ft. of logs to be hauled by one horse on a pair of sledges, the fore sledge short, and the rear one, which carries most of the weight (thereby making starting easier), long and low. The most favourable type of road for this purpose is a snow road with iced ruts, which will stand track pressures up to 2 kg. per sq. cm. as compared with 0·8–1·0 for an ordinary snow road, and on which if the gradient is negligible it is theoretically possible for a horse to draw a load of 500 cu. ft. Construction and maintenance costs for roads with iced ruts can be brought to a very small proportion of total costs. The ideal sledge has yet to be designed, but two types (figured) of existing sledge design have proved good. Most emphasis, however, is placed on the method of loading, as with large loads it is essential that accidents should be prevented and that loading should not require undue time and exertion. In the method recommended (stages illustrated) the roadside stacks of logs are raised above road level and from these the sledge load is built up in tiers successively overhung at the sides, the top tier being 60 per cent. broader than the bottom. Most of the logs are loaded with butts to the rear, in order to throw the greatest weight on to the rear sledge. Each tier has thicker logs at the edges than in the middle, and round each, as soon as built, chains are passed and locked without tightening, the necessary tension being obtained by the weight of the next tier. Each tier contains more logs of smaller average volume than the preceding one, as shown by the following typical load:

Tier	*No. of logs*	*Cu. ft.*	*Average volume per log*
1	6	63	10·5
2	7	71	10·2
3	9	79	8·8
4	14	72	5·1
5	16	63	3·9
	52	348	6·7

This load was built up, under favourable conditions, by two men in 50 minutes.

[338]. 32.91.4 : 07.7. Morozov, A. V. Znachenie rel'sovoy lesovy̅vozki. (K vy̅boru tipov oborudovaniya.) **[Importance of extraction by rail. (On the choice of types of equipment.)]** *Lesnaya Prom.* No. 5/6, 1945 (2–4). [Russ.]

Narrow-gauge (750 mm.) railways have proved the most effective and cheapest means of timber extraction in the U.S.S.R., but in spite of a government directive in November 1938, that use of this form of transport should be considerably increased, there is still room for its introduction on a much larger scale. Nevertheless, in 1943, the quantities of timber extracted respectively on narrow-gauge railways and on tractor roads were roughly equal, in spite of the fact that there were almost 10 times as many tractors as locomotives and the hauling distance for the latter averaged twice as much as for the former. A tabular comparison is made of specifications of an old type of steam locomotive and a type (P–24), produced in 1941 by the Kolomensk works, which very closely resembles a new draft specification for a wood-burning steam locomotive. The P–24, which was run on coal or wood, is estimated to be capable of transporting 50,000 cu.m. of timber annually with an average load per 20-km. trip of 120 cu.m. This type is suitable for the larger blocks of forest with a growing stock of 1 million cu.m. and over, an annual out-turn of 150,000–200,000 cu.m. and an exploitation period of 7–10 years. The specifications are also included of two types of light locomotive driven on wood-gas, and a proposed improved design which should be capable of an annual performance of 20,000 cu.m. assuming an average load per 10-km. trip of 35 cu.m. This type is suitable for lighter and portable rail systems in smaller blocks of forest where it is desired to reduce skidding as much as possible. Specifications of rails are also included.

[339]. 32.92–4 (47.0). Orlov, N. N. Mekhanizatsiya i ratsionalizatsiya splavny̅kh rabot. **[Mechanization and rationalization of floating operations.]** *Lesnaya Prom.* No. 3/4, 1945 (5–7). [Russ.]

A brief report on the progress of mechanization and rationalization in timber-floating operations from 1934 to 1944 in the whole U.S.S.R. In 1943 floating proper accounted for 8,700,000 man days, and preparatory and auxiliary work for 5,600,000 man days.

In percentage of the total time spent, the following phases of the operations made up:—rolling logs 6·2 (10–15 per cent. mechanized); initial floating 56·1 (not mechanized; rationalized to about 25–30 per cent.); rafting 3·7 (mechanized and rationalized to about 65 per cent.); sorting and miscellaneous work at water roadsteads 5·0 (not mechanized; sorting rationalized to about 80 per cent.); raft building and 'transit' floating 17·5 (former 90 per cent. mechanized; latter 45 per cent. rationalized); loading and unloading 12·5 (45 per cent. mechanized and rationalized).

Further exploitation of Russia's river system is highly desirable: of the total length of rivers, i.e. about 1,200,000 km., timber floating is done on only about 300,000 of which 200,000 are used by organizations under the People's Commissariat of the Forest Industry (Narkomles). The need for all possible mechanization and rationalization of the work is discussed with special reference to improved booming of rivers, concentration of floating operations in the early spring period so far as possible, greatest possible use of rafting with rationalized types of raft, etc.

[340]. 32.92–4 (47.0). Prilutski, A. V. Osvoenie melkoy rechnoy seti. [**Utilization of the smaller river network.**] *Lesnaya Prom.* No. 9, 1945 (10–2). [Russ.]

As land transport of timber in the U.S.S.R. is estimated to be about 30 times as expensive as river floating, it is evident that far more attention should be given to the use of the smaller rivers and streams for this purpose. Full use must be made of the short period (usually 3–5 days) of spring freshets, when timber of considerable length can be floated out, whereas when the water returns within the banks 4- to 6·5-m. logs, and at low water 1- to 2-m. logs should be dealt with. Stacks of wood along the banks should be arranged with this in mind and with the aim of getting the logs into the water as quickly as possible. Where the ice is very quick in breaking, stacks can be made on the ice itself before the thaws. Bank patrols are essential and 5–20 men, according to width of bed, current and material floated, will be required per km. of bank. The organization of work along the smaller rivers will also vary with that on the main rivers, e.g. where floating is practised on the latter the logs from tributaries can simply join the main drive, or if rafting is practised they may be held and made into rafts, floated loose when rafting is finished, or floated together with the rafts if there are suitable sorting booms downstream. Brief notes are also included on a few small rivers where floating is practised and stream improvements have been made.

[341]. 32.92–4 : 07.7. Tsirulev, A. I. Ratsional’nye sposobȳ formirovaniya rechnȳkh plotov TsNII lesosplava. [**Rational methods of building river rafts as developed by the Timber-floating Central Research Institute.**] *Lesnaya Prom.* No. 3/4, 1945 (8–10). [Russ.]

Up to 20 per cent. of the total time spent in rafting operations goes in the actual building of the rafts. A rationalized method is described, applicable where the current does not exceed 1–1·2 m. per sec., in which both bundles of logs and raft-framing timbers are floated direct along boomed corridors to a raft-building enclosure where the framing is made up into a type of cradle, the log bundles are loaded in, and complete raft sections are built up on the spot. Four lay-outs (for various widths of river) are described and figured for the booming of approach corridors and enclosures for building raft sections.

[342]. 32.92–4 : 07.7. Arnshteyn, G. E. Razmolevochnye stanki. [**Installations for dismantling timber rafts.**] *Lesnaya Prom.* No. 5/6, 1945 (12–4). [Russ.]

The installation described is designed to eliminate waste and trouble from sunken timber and subsequent silting in harbours receiving and landing rafted timber. It consists essentially of a floating pontoon or boom framework enclosing a reception tank, where the rafts are dismantled, and a sectionally constructed floating ‘flume’ along which the timber is led to a log elevator at the bank. The reception tank is boarded in at the sides and bottom, and the latter can be raised by 2 winches; thus, when rafts are broken up, sinkers,tackle, tools, etc., are trapped and can be recovered periodically. Two workers are required to bring in the rafted timber, two to break down the bundles and, to move the logs along the ‘flume’, two per 30-m. length of flume. It is estimated that the installation can deal with 840 cu.m. of timber per 8-hour shift. Diagrams of the installation and of suggested lay-outs are included, with notes on materials necessary and approximate construction costs.

[343]. 32.92–4 : 07.7. Arȳkin, I. G. Zashchita opornȳkh plitok i vȳnosov ot zasoreniya drevesinoy. [**Protection of boom head floats and guys against fouling by logs.**] *Lesnaya Prom.* No. 3/4, 1945 (8). [Russ.]

Where the main boom at a landing depot is of the type held parallel to the bank by guys, the first of which is attached to a float at the head of the boom moored in midstream by two anchors, a certain number of logs are liable to jam in the anchor cables and the first bank guy, and a good deal of trouble may be caused by choking of the entrance or by the head float breaking from its moorings. This may be avoided by anchoring a short rudder boom immediately upstream of the head float to deflect the logs towards the bank. If the stream is rapid a plank guard should be fixed underneath this rudder boom, but with currents up to 1·2 m. per sec. the simple boom, placed at an angle of 15° to the stream, is sufficient protection.

[344]. 32.95. Stovall, C. **How to top a spar tree with explosives.** *Timberman* 47 (4), 1945–46 (49, 52).

Spar trees are usually topped by a high climber using an axe and saw for cutting the top off at the required point. This method is sometimes unsafe and explosives may then be used for this purpose. This article describes in detail the procedure to be followed in topping by this method. When 40–60 per cent. gelatin powder is used the tree top is cut away instantly leaving a spar with a fairly smooth top end.

[345]. 32.96 : 33.7 : 33.51 : 07.7. Smirnov, E. K. Paketnaya pogruzka drov i rudnichnoy stoyki. **[A 'packet' method of loading fuel-wood and pitwood.]** *Lesnaya Prom.* No. 9, 1945 (4–7). [Russ.]

Description, with diagrams and photographs, of apparatus and methods used for making 'packets' of short logs and transferring them in a temporary framing to open railway trucks. The apparatus used consists of 4 pairs of vertical tubular stakes with fixed cross-members at the base and hinged ones at the top. In this the packet is built up to final dimensions of 8 m. long, 2·4 m. wide and 1·65 m. high, containing 31 stacked cu.m. of wood and having a total weight of 20 metric tons. A shell is made of the longer logs (3·5-m. logs at each end, the gap in the middle filled with 2-m. logs overlapping the former on the inside), containing a core of 1-m. logs. When the packet is complete the top cross-members are clamped down and two hand winches are used to pull the load on to a railway truck. The sides of the latter are first let down, a row of vertical retaining stakes inserted on the off-side, 4 wooden bunks laid on the deck, on to which the packet runs on rollers. Once in position, retaining stakes are inserted on the near side of the truck and a special contrivance allows the load to be lowered on to the bunks leaving the rollers, etc. free for removal. The temporary framing (tubular stakes and cross-members) are also removed and the packet secured on the truck by wire cable in the usual manner. A gang of 4 men can build a packet in 2¼ hours (6 men in 1½ hours) and all the work of transferring the packet to a truck can be done in 22 mins. There is a saving, in both time and number of workers required for loading, as compared with the usual method of loading. A special lock for the cables used on the truck is also described.

33. CONVERSION AND PRESERVATION OF WOOD

[346]. **Conference report on new developments in wood products.** New York State College of Forestry, Syracuse University, New York. Oct. 6 & 7, 1944. pp. 144.

The following papers, read at the conference, are printed in this report: Wartime wood products in Sweden, by E. C. Jahn [cf. *For. Abstr.* 7 (No. 311)]; Methylolurea transmuted wood, by J. F. T. Berliner [cf. *For. Abstr.* 6 (31)]; Recent developments in fire-resistant treatment of wood, by F. A. Hartmann [cf. *For. Abstr.* 7 (No. 872)]; High frequency heating applied to wood products, by P. D. Zottu; The influence of modern glues on the utilization of wood, by W. F. Leicester; New uses of glued laminated structures, by V. Ketchum; Synthetic resin lamination for marine use, by C. D. Dosker; The problem of wood research, by C. Rishall; Looking forward in forestry education, by J. S. Illick; New wood products in our future economy, by G. V. Trayer; Recent developments in cellulose and lignin plastics, by F. C. Peterson; New developments in pulp and paper products, by L. A. Beeman.

[347]. 33 (47.2). Kamenir, I. **Karelian forests.** *Timber of Canada* 6 (5), 1945–46 (8–9).

Before the war the annual timber production in the area now occupied by the Karelian-Finnish Soviet Republic was 9,600,000 cu.m. A great expansion in production and in timber industries is proposed in the fourth 5-year plan.

33.1. *Mechanical Conversion excluding the Manufacture of Mechanical Pulp*

[348]. 33.1 (71) : 09.4. Canada. **Wood-using industries in Canada, 1943.** Dominion Bureau of Statistics, Ottawa. 1946. pp. 30. [E.F.]

The tables give, first, a review of the principal statistics of the wood-using industries from 1924 to 1943, followed by a summary of the principal statistics for 1942 and 1943, and detailed tables covering capital invested, employment, power equipment, fuel, electricity, materials used and products manufactured.

[349]. 33.1 : 34.6. WHITE, J. W. **Comparisons of sawdust and wheat straw for bedding.** *Bull. Ntheast. Wood Utiliz. Coun.* No. 7, 1945 (37). P.R.

Both the dairy and the poultry industries of the north-eastern United States are using increasing amounts of sawdust and wood shavings for litter as substitutes for wheat straw. A study was undertaken at the Pennsylvania Agric. Exp. Station to determine the comparative values of these materials in the production of farm crops and their behaviour when incorporated with the soil with respect to the rate of decomposition and influence on soil nitrate production. Sawdust gave excellent results compared with wheat straw. The following table gives a summary of the results.

Material studied	*Rate of decay mg.* CO_2	*Nitrate nitrogen p.p.m.*	*Corn crop Pounds per acre*
Soil and straw	1,992	595	—
Soil and sawdust	1,592	544	—
Stable manure and straw	2,671	565	4,922
Stable manure and sawdust	1,993	647	5,033
Hen manure and straw	2,331	768	4,837
Hen manure and sawdust	2,242	859	5,014

Note.—Three tons hen manure compared with 9 tons stable manure. Each mixed with 10 per cent. litter or bedding. Rate of decomposition is based upon the milligrams of CO_2 recovered in five months.

[Cf. *For. Abstr.* 7 (Nos. 1988-9).]

[350]. 33.1 : 34.6 : 31.24. GUTERMAN, M. N. Koefitsientȳ perevoda drevesnȳkh otkhodov v uslovnoe toplivo. **[Conversion factors for expressing the calorific value of wood waste in terms of a standard fuel.]** *Lesnaya Prom.* No. 3/4, 1945 (10–24). [Russ.]

Data on the use of wood waste as fuel in enterprises under the People's Commissariat of the Forest Industry (Narkomles) are difficult to handle, whether for planning or control of operations, owing to the lack of standard units of comparison. The problem of establishing comparative fuel values for different types of waste is discussed with particular reference to the statement of calorific values in 'fuel equivalents' expressing any particular fuel in terms of a hypothetical 'standard fuel' yielding 7,000 cal. per kg. Provisional tables are given for sawdust, chips, shavings, a mixture of these three, and for slabs, edgings and offcuts, of Pine, Aspen, Spruce, Siberian Pine, Nordmann Fir, other species of Fir, Larch, Birch, and Oriental Beech, to show calorific values per cu.m. and factors for converting loose or stacked measure to metric tons of 'standard fuel', with due allowance for depth of layer or method of stacking, and for moisture content. Similar tables are provided for Birch wastes from the plywood industry and (for works that calculate waste as the difference in solid volume between intake of logs and output of converted timber) for the same data in relation to solid volume.

The theoretical basis of these tables is discussed in some detail. For works where the moisture content of the waste is not determined, tentative data are included on the average annual moisture content of different types of waste.

[351]. 33.1 : 34.6 : 33.32.3. **Process for utilizing wood waste announced by Brooklyn engineers.** *Sth. Lumberm.* 171 (2148), 1945 (39).

A preliminary, general account of a new process for making wallboard out of sawdust, chips and other small woodwaste, developed in the Department of Chemical Engineering at the Polytechnic Institute of Brooklyn. The sawdust is mixed with chemical substances derived as waste products from wood-utilizing industries, which cost less than 0·1 cent per sq. ft. The catalytic action of these wood-derived chemicals causes the wood waste to recombine into a strong grainless board. It is claimed that the process is so simple and the cost of equipment so low that any sawmill with a production of a few tons of sawdust a day should now be able to make profits on its sawdust. Mixing takes only a minute or two and ten minutes are required for making the board by squeezing the mixture in a hydraulic press. The board is said to be resistant to termites, rot, moisture, warping, swelling and shrinking; it can be moulded like a plastic to any size, thickness and shape.

[For further references on utilization of wood waste see *For. Abstr.* 8 (Nos. 440, 449, 523, 524–7).]

33.12 Joinery, Turnery

[352]. 33.12. Great Britain. **Wood trim.** *Brit. Stand.* No. 584, 1946. pp. 9. P.R.

A new British Standard covering the production of Wood Trim, i.e. products of uniform profile, manufactured by linear machining only. Conditions governing the selection, finish and priming of the timber are laid down. Profile and dimensions of each standard moulding are shown. The range comprises architraves, skirtings, picture rails, internal door thresholds, cover strips, quadrant and half-round beads and scotias.

[353]. 33.12. Izyumski, P. P. Rasshirenie assortimenta drevesnȳkh porod v kolesnom proizvodstve. **[Wider use of different kinds of timber in wheelwrighting.]** *Lesnaya Prom.* No. 9, 1945 (2–4). [Russ.]

Tests were made of a number of hard- and soft-wooded deciduous species as substitutes for the Oak and Ash normally used for felloes. Blanks were prepared from logs over 14 cm. diam. and from those under 10 cm. diam. Complete circular bends (of diameter 570, 720 and 900 mm.) were made, using smooth or ribbed moulds. Optimum steaming periods for freshly cut timber are shown below:—

Species	*Blanks from thick logs (hours)*	*Blanks from thin logs (hours)*
Aspen	1–2	—
White Poplar	1·5–2·5	—
[?White] Willow	1·5–2·5	1·5–2
Alder	2–3	2–2·5
Birch	3–5	2·5–4
Elm (two spp.)	4–6	3–5
Oak, Maple	–	4–8
Ash	–	6–10

Birch gave good results after steaming for 3–4 hours, cooling for 1·5–2 hours, and steaming again for 1–2 hours. The best bends were given by Oak, two species of Elm, and Birch. Sawn blanks of Elm gave as good bends as cleft ones. Of the softer woods the best benders were Aspen and [?White] Willow; Alder and White Poplar were intermediate, and Black Poplar and Lime worst. It was found necessary, with the softer species, to make incisions 2–3 mm. deep and spaced 25–50 mm. apart on the inner surface of the blank, a method which also gave good results with material from small-diameter logs of the harder woods. If due allowance is made in thickness, the incisions can be planed out when the bend is completed. The softer woods gave better bends on ribbed than on smooth moulds. From the above and from some practical tests of the wheels made, it is concluded that for wheels with one felloe forming the complete circle, Elm, Aspen and Willow may be used, though the two latter must be shod. Poplar, Lime, Alder and Pine may be used for wheels built up of separate felloes.

Naves and spokes in wheels with felloes of soft-wooded species must continue to be made of the usual hard woods. The felloe end of the spokes should be rectangular in section, which should be increased to 50 × 50 mm. Lateral movement of the felloes should be prevented by metal or wooden dowels inserted on the surface next to the tyre. Felloes of soft woods should be brushed 2–3 times, being allowed to dry between applications, with hot Pine or Birch tar or a preservative of equivalent strength. Further species should be tried, e.g. Larch, and in the interests of economy, further trials should be made with felloes from small-diameter logs of the hard-wooded species.

[354]. 33.12 : 07.7. Haycock, A. H. **The hollow chisel.** *Wood* 11 (3), 1946 (83–5).

The hollow chisel is slower than the chain-mortising machine, but is more accurate in small sizes and short lengths. Methods of sharpening and filing the smaller sizes of hollow chisel are recommended. The design, setting and sharpening of the auger are described and methods of preventing clogging are dealt with. The author finally explains the setting-up of the hollow-chisel machine and its uses. The standard hollow chisel machine can be used for purposes other than mortising proper, e.g. for haunching and relishing sash and door rails, and for round hole boring, provided that suitable boring bits are available.

33.13. Cooperage

[355]. 33.13. **American timber.** *Brew. Tr. Rev.* 60 (718), 1946 (119–20). L.S.

A note on timber available for the manufeacture of beer casks in the U.K. The process of pressing imported American White Oak reduces its tendency to contaminate the beer and renders it less porous than cleft American White Oak or Memel Oak. The author recommends that when supplies of Memel Oak are again available the sawn pressed method should still be used.

[356]. 33.13 : 31.27. Myers, E. C., Purcell, M. T., and Kurtenacker, R. S. **Effect of species and thickness of head and type and attachment of cleat upon the strength of slack barrel heads.** *Barrel & Box* 50 (8; 9), 1945 (9–13; 9–12). P.R.

An account of tests made at F.P.L., Madison, to determine the effect of species and thickness of head and the type and attachment of cleat upon the strength of barrel heads of Douglas Fir, Southern Yellow Pine and Cottonwood. Results showed that additional barrel-head strength was obtained by increased thickness of head, by the use of cleats, or by a combination of both. Heads of Douglas Fir had the greatest average strength, and wood-cleated barrel heads had the greatest advantage in centre-compression and centre drop puncture tests, when the load was applied to any part of the cleat, the resistance increasing with the width of the cleat. Methods of attachment were not thought to affect the strength of the head materially, but recommendation as to types of fastenings are made. Results are given in tabulated and graphical form.

33.15. Manufacture and Use of Veneers and Laminated Wood. Improved Woods. Laminated Materials other than Wood. Glues and Gluing

33.15.1. *Manufacture of Veneers and Laminated Wood*

See also *For. Abstr.* 8 (No. 465).

[357]. 33.15.1 (81). A nova e florescente indústria da madera compensada. **[The new and flourishing plywood industry.]** *Brasil madeireiro* 1 (1), 1945 (10–3, 8). [Port.]

The Brazilian plywood industry has developed rapidly within recent years and of 168 projected plywood factories, 102 are already working and 66 are being built. The factories already working can produce 51,700 cu.m. per month. The total estimated monthly production of all existing and proposed factories is 100,889 cu.m. Data are included on the export of laminated woods for the first half of 1944, and lists are given of the various plywood factories situated in São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul.

[358]. 33.15.1. Sanders, H. **Converting logs into veneer.** *Timber News* 54 (2082), 1946 (142–4). P.R.

The article describes methods of cutting veneers, i.e. rotary cutting, slicing, segment sawing and half-round cutting. The sorting and storage of logs and ways of making veneer flitches are also briefly dealt with.

[359]. 33.15.1. **Phenolic faced single ply.** *Timberman* 47 (3), 1945–46 (136, 138).

An account of tests made on Super-Harborite a composite board of rotary-cut Douglas Fir veneer, 0·090-in. thick, on each side of which is bonded a sheet of 0·015-in. semi-kraft paper weighing about 50 lb. per 1,000 sq. ft. The bonding process involves impregnating the paper with a water-soluble, phenolic-type, synthetic resin and drying at a temperature low enough to keep the resin in an active state; the sheets are then coated on one side with an aqueous solution of a phenolic-type synthetic resin and assembled with the rotary-cut veneer. The whole assembly is then hot-pressed to produce a water-resistant bond between the veneer and the paper sheets and between adjacent fibres within the sheet. Each 1,000 sq. ft. of 0·015-in. kraft paper contains about 24 lb. of resin. In the static loading test at 85 lb. per sq. ft. no noticeable failure was produced. A static load puncture test and impact puncture test showed that Super-Harborite, while having good static strength, has low impact resistance.

[360]. 33.15.1 : 07.7 : 82. Muelier, L. A. **Veneer clipper safety guard.** *Timberman* 46 (12), 1944–45 (100). [U.S. Forest Products Laboratory, Madison, Wis.]

Accidents, sometimes resulting in the loss of fingers, often occur in the operation of veneer clippers. The Forest Products Laboratory, Madison, has now designed a guard of transparent plastic for its electrically driven, foot-operated 66-in. veneer clipper. This, while preventing the hands of the operator from coming into contact with the knife edge, does not obstruct visibility.

[361]. 33.15.1 : 33.15.4. Jones, W. Y. **[Moulded] laminated materials.** *Brit. Patent* No. 572,267, May 26, 1943. Brit. Abstr. B II, 1946 (55). P.R.

Laminated material (3-ply) of improved dimensional stability is produced from a core consisting of a fabric woven from textile threads and metal wires and impregnated with synthetic resin (phenolic or urea), and wood veneers; these veneers may also be impregnated with synthetic resin and are secured to the core by a synthetic adhesive or cement (phenolic, urea, or vinyl) under heat and pressure (160° at 500 lb. per sq. in.).

[362]. 33.15.1 : 33.15.5. **The laminating of timber products with low-temperature, phenolic-type resin glues.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1937, 1944. pp. 41 + plates. P.R.

A comprehensive manual dealing with the characteristics of lumber and glue for laminating, laminating procedure, space requirements and equipment necessary for laminating straight and curved timbers. This information is presented in a somewhat summarized form and references are given to more detailed publications on various other aspects of the work.

[363]. 33.15.1 : 31.27. **Sandwich construction—end compression tests of flat panels with stiffened cores.** *Rep. Naval Air Exp. Sta., Philadelphia* No. AML NAM 2408, 1945. pp. 11 + tbls. + plates. P.R.

A report of tests made at the U.S. Naval Air Experiment Station, Philadelphia, to compare the efficiency of stiffened- and unstiffened-core sandwich panels. The flat sandwich panels had a Balsa-wood core, and fibreglas and 24S-T alclad faces. Panels with and without Douglas Fir stiffeners were tested in compression. No definite increase in efficiency was found in the stiffened panels and, considering the time and expense involved in their manufacture, no advantage appears to be gained by using such panels.

[364]. 33.15.1 : 33.4. **Glued laminated hardwood flooring.** *Timberman* 47 (2), 1945-46 (82, 84).

A process and equipment developed by the Tennessee Valley Authority for producing flooring from cull hardwoods are being demonstrated at an experimental plant in Knoxville, Tennessee. The flooring material consists of plies of wood slats assembled, glued, and pressed together in continuous operation through a press. The flooring is 3-ply, $\frac{25}{32}$ in. thick, 12 in. wide, and of any desired length. Slats are $\frac{27}{100}$ in. thick and $\frac{3}{32}$ in. wide. The centre plies are fed crosswise into the continuous hydraulic glue press, the top and bottom plies placed 4 slats wide on assembly belts above and below respectively. From this point the slats move to assembly, heat, glue, 200 lb pressure to a sq. in., re-heating, and side-matching (tongue and groove), to produce cross-laminated flooring in endless length. It is cut where desired, as it issues from the press, then sanded and finished.

[365]. 33.15.1 : 33.4 : 12.26–8. **Flooring from lower grade hardwoods?** *Timber News* 54 (2082), 1946 (138–9). P.R.

A discussion of the problem of utilizing third- and fourth-grade English Oak. Reference is made to experiments of the Tennessee Valley Authority, which aimed at producing from low-grade hardwood a three-ply composite board for flooring. The manufacture of this board is briefly described. [See previous abstract.]

33.15.2. *Use of Plywood and other Laminated Wood*

See also *For. Abstr.* 8 (No. 538).

[366]. 33.15.2. **Fifteenth Annual Plywood Review.** *Timberman* 47 (3), 1945–46.

In addition to the articles abstracted in the present issue of *Forestry Abstracts*, this number of *The Timberman* has short articles on the use of plywood for advertisement hoardings, houses, farm buildings and equipment, sports floors, concrete formation, roof construction, car construction, life-saving rafts, shop fixtures.

[367]. 33.15.2. Perkins, H. S. **Expanding markets for oversize panels.** *Timberman* 47 (3), 1945–46 (38–40, 80, 85, 101–2).

The Illinois Central Railroad Company has recently used outsize sheets of plywood for rebuilding old refrigerator coaches. Panels $\frac{5}{8}$-in. thick were applied to both ends and sides of coaches. Until recently, outsize panels were usually made only to order, but manufacturers are beginning to stock them, in lengths up to 50 ft., widths up to 9 ft. and thicknesses from $\frac{3}{16}$ to $\frac{17}{16}$ in., which are produced by joining together stock sizes of plywood with a high-strength, low-angle scarf joint. The joining of segments to facilitate maximum curvature in one or more parts of the panel is accomplished by arranging the individual sections so that, where greatest bending is desired, it will occur at right angles to the grain of the plies of the panel. An example of this is provided by the 32-ft. panels used for building certain military boats. In the centre two-thirds of the panel, the grain of the face plies is parallel to the length of the boat, while the end sections of the panel (to form the bow and stern of the boat) are joined so that the grain in face plies is almost at right angles to that in the centre of the panel. Although panels as large as 20 or 30 ft. long and 8 or 9 ft. wide may be used economically when many coaches are to be constructed at one time, for the building or rebuilding of relatively few coaches, the most efficient use of the material would probably be in panels as long as desired (perhaps 20 ft.) but not more than 4 ft. wide. Panels $\frac{9}{16}$ or $\frac{5}{8}$ in. thick are the thicknesses preferred for long lengths. Details are given of the various joints and nails used for fastening these large panels.

[368]. 33.15.2. Kelson, S. **Structures containing veneers or plywood.** *Brit. Patent* No. 575,032, Jan. 31, 1946. *Timber News* 54 (2082), 1946 (156). P.R.

Strips of veneer or plywood are secured to each other at regular and staggered intervals, so that the structure in its final form can be expanded like a lattice and spacers inserted. The spaces may be filled with insulating material if required.

[369]. 33.15.2 : 33.8. Kennedy, D. E., and Wakefield, W. E. **Laminated wood for sleigh construction.** *Pulp Paper Mag. Can.* 47 (1), 1946 (58–9).

A few tests were made to determine the relative strengths of glued laminated sleigh runners and sleigh beams and those of one-piece construction, the material used being in each case Yellow Birch. The results indicate that glued laminated runners and beams are as strong as solid ones, provided that good gluing technique is used and the laminations are so placed that the strongest takes the maximum stress.

[370]. 33.15.2 : 33.8 : 12.25. Schrader, O. H. **Marine applications of Douglas Fir plywood.** *Timberman* 47 (3), 1945–46 (108–110, 114). [College of Forestry, Univ. of Washington.]

A summary of the uses of plywood in shipbuilding, with particular reference to a series of twelve 43-ft. fishing vessels built, or under construction, by the Steel-Enders Corp. of Seattle; the bow and stern sections of the hull are each single units of welded steel. The midship section, deck, bulkheads and deck house are of exterior plywood, except that the beams and stringers for the deck house are of laminated Douglas Fir. A long panel of plywood, $1\frac{1}{2}$ in. × 45 in. × 29 ft., made from two $\frac{3}{4}$-in. panels, is employed as a garboard strake and runs from the bow to the stern keel end and from the keel to the turn of the bilge. This panel is not moulded, but maximum advantage of its bending capabilities is realized by the double panel construction and by making a 'fish-tail' cut-out at the stern end, so that the upper edge of the plywood panel coincides with the line of the planking for the rest of the hull. This cut-out section is plugged by means of a shaped panel section, using a shiplap type of joint. So far as is known, this is the first application of this planking principle, and a patent application has been made for it.

[371]. 33.15.2 : 33.8. **Plywood tuna clipper.** *Timberman* 47 (3), 1945–46 (42–5).

Description of the deep-sea fishing craft 'El Dorado'. She is 80 ft. long, 20 ft. in beam, and draws 11 ft. (loaded). The 250-h.p. diesel engine drives her at 10 knots; with fuel storage of 14,000 gallons, she has a cruising radius of 10,000 miles, and can carry 105 tons of frozen fish. She cost about $135,000. The fish tanks, hatch covers, pilot house, floor boards, bulkheads and 3 tenders are all constructed of Douglas Fir plywood, of which 13,000 super. ft. were used.

[372]. 33.15.2 : 33.8. **Circular camel of laminated wood designed to prevent damage to ships.** *B.C. Lumberm.* 29 (12) 1945 (75). Also in *Timberman* 47 (2), 1945–46 (84).

A new type, cylindrical 'camel' of laminated Oak, used to prevent damage to ships while lading, has been produced by Gamble Brothers, Inc., Louisville, and application for a patent filed. The principle of the new camel is a series of split rings of laminated Oak, joined by strakes of the same material in such a manner that it absorbs not only compressive action but also longitudinal rack. The camel weighs only 6 tons but will absorb without crushing a total load of 250 tons.

33.15.3. *Improved Woods*

[373]. 33.15.3. Young, S. H. A., Palese, R. A. M., and Berliner, J. F. T. **Engineered wood.** *Sth. Lumberm.* 171 (2153), 1945 (181–5).

A general account of the processes of impregnating, moulding, and compressing wood to produce the various types of 'improved' wood. Patents have been applied for to cover a new method requiring much less time and resin than previous methods. It involves impregnating wood with urea in the presence of high-pressure steam. The action may be enhanced by the use of other chemicals with the urea, or possibly in place of the urea. This phase of the investigation is still in progress. High degrees of flexibility are attainable in the wood, and it seems that it may be possible to treat dry wood, bend it while hot, and cool it on forms to retain the shape given it while hot.

[374]. 33.15.3. **Asidbar.** *Gen. Inform. Bull. Koppers Co., Pittsburgh, Pa.* No. 35, 1945. pp. 2. P.R.

Koppers' Asidbar is wood processed to effect the deep penetration and distribution of an acid-resistant special bituminous compound, thereby providing wooden articles with acid resistance and requisite structural strength. The injected materials, usually in excess of 50 per cent. of the weight of the wood processed, coat and fill the fibres to a considerable depth beneath the surface and throughout pieces of moderate cross-section. After treatment the acid-resisting impregnant or filler is solid at temperatures up to approximately 130–140° F. The effect of the impregnant is to inhibit absorption by the processed wood of acids, moisture or fumes and to protect surface and interior wood fibres against deterioration.

[375]. 33.15.3. **Treated wood resists acid.** *Sth. Lumberm.* 171 (2153), 1945 (306).

Structures exposed to rapid deterioration by contact with acid solutions or fumes can be made acid-resistant by using Asidbar, a plastic-impregnated wood developed by Koppers Wood Preserving Technical Department, Orrville, Ohio. The plastic treating material is liquefied by high temperature and the wood is immersed in the compound in sealed retorts. The plastic is forced deeply into the wood-fibres by high pressure at temperatures sufficiently high to hold the compound in a liquid state. After a period of 10 to 20 hours the plastic sets solid in the cells of the wood as it is allowed to cool. The treatment increases the weight and hardness of the wood and gives it a black surface which need not be painted; resistance to wear and abrasion, water, and chemicals are considerably increased, and so is dimensional stability when subject to alternate wetting and drying. The properties of Asidbar are said to make it suitable for many requirements of severe service conditions at temperatures up to 108° F. In one experiment, Southern Yellow Pine guides treated by the process were subjected to a 10- to 15-per-cent. sulphuric acid at temperatures of 180° F. and were sound and firm after 18 months' service, while untreated wood lasted only 2 to 3 weeks. Use of this treated wood for greenhouse construction, to ward off the effects of moisture and decay, is being experimented with.

[376]. 33.15.3. Amer. Foundry Equipment Co. **Wood product.** *Brit. Patent* No. 572,563, April 4, 1944. Brit. Abstr. BI, 1946 (68). P.R.

The surface pores of wood are tightly caulked with an inorganic powder (e.g. SiO_2) free from binder, by bombarding the surface with (steel) shot mixed, or pre-coated, with the powder. Excess of powder is finally removed from the surface of the wood.

[377]. 33.15.3. Burr, H. K., and Stamm, A. J. **Comparison of commercial water-soluble phenolformaldehyde resinoids for wood impregnation.** *Rep. U. S. For. Prod. Lab., Madison* No. 1384 (revised), 1945. pp. 12 + tbls + addendum. P.R.

Ten different commercial water-soluble resins are evaluated for use in the manufacture of impreg and compreg. They are compared relative to their solubility, solids content (by a new reproducible method), viscosity, hydrogen-ion concentration, and curing conditions. Practically equal anti-shrink efficiencies were obtained on impreg made with the following resinoids: Amberlite PR–50, Bakelite BP5995, Bakelite BR15100, Bakelite XJ16235, Cent.

Proc. Corp. Resin No. 1652, Compregnite, Durez No. 6686, Durez No. 12133, General Electric No. 1181, Monsanto Resinox No. 461. Compreg made with these same treating resinoids, both with and without an additional bonding resin, had high shear strengths and good Izod values as judged from the notched toughness strengths. *Authors' summary.*

[378]. 33.15.3 : 31.21.4. Weatherwax, R. C., and Stamm, A. J. **The electrical resistivity of resin-treated wood and paper-base plastics.** *Elect. Engng., N.Y.* 64 (12), 1945 (833–8). P.O.

An account of experiments made on simple sheets of normal wood and impreg and compreg of ten different species, after kiln drying and in equilibrium with four different relative humidities, in order to measure their electrical resistivity and to determine the changes resulting from variations in resin content, degree of compression and presence of glue line in laminated material. The extent of surface resistivity of the resin-treated wood was also investigated and volume resistivities for a limited number of hydrolysed-wood sheet specimens containing both aniline-furfural and phenol-formaldehyde resins and for laminated Mitscherlich sulphite paper treated with both water- and alcohol-soluble phenolic resins were also determined. The method of making d.-c. resistivity measurements with a sensitive galvanometer used as an ammeter in an ammeter-voltmeter circuit is described and the results are shown in graphical form.

Comparisons of average resistivity for untreated wood, impreg and compreg show that the volume resistivity of all the laminated plastics is equal to or better than that of normal wood. Resistivity depends on the moisture content, and the volume-resistivity/relative-humidity curves show the variations. At 30 per cent. relative humidity impreg and compreg have volume resistivities about 10 times that of normal wood, and at 90 per cent., about 100 to 1,000 times, the impreg values being slightly greater than those of compreg. Resistivity increases with resin content up to about 30 per cent. of resin content, but decreases again at a very high resin content. The surface resistivity at relative humidities below about 40 per cent. is sufficiently small to be ineffective. The insulating properties of dry material exposed to higher relative humidities are largely determined by surface conductivity effects.

The volume resistivities of the laminated-paper plastics and hydrolysed-wood plastics are somewhat lower than those of impreg and compreg.

Tables show the electrical resistance of impreg and compreg, hydrolysed-wood sheet and Mitscherlich paper measured according to the ASTM method and indicate that all the resin-treated materials reported upon are suitable for insulating purposes. This method however measures primarily surface resistance and the volume-resistivity curves are a better means of judging the insulating properties of the materials under prolonged exposure to high relative humdities.

33.15.4. *Laminated Materials other than Wood*

See also *For. Abstr.* 8 (No. 440).

[379]. 33.15.4. Jungmann, E. C. **Development of a counterpart vertical fin of papreg for the AT–6 airplane.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1594, 1945. pp. 12 + plates + tbls. P.R.

A vertical fin, designed and fabricated from papreg, was tested under static loads representing gust and steady dive conditions. The metal fin for the same airplane is of conventional two-spar construction with ribs. In the development of the papreg fin, trials of complete fins and of several rear spar designs led to the adoption of a semimonocoque design as most suitable because of the properties of the materials used. This fin was made of 0·020-in. parallel-laminated papreg. The core was three-ply $\frac{1}{60}$-in. Yellow Poplar plywood glued with high-temperature-setting, phenolic-resin film glue, cross-banded at 90° with the grain at 45° to the fibre direction of the papreg facings. The papreg fin, equipped with an I-beam rear spar of papreg, supported 200 per cent. of the design load in static gust-load tests. Stress data obtained indicate that the papreg fin tested did not exceed the aluminium fin in weight and that its weight could be further reduced.

33.15.5. *Glues and Gluing*

[380]. 33.15.5. Perry, T. D. **Resin adhesives become established: looking over**

last decade—1935–45. *Timberman* 47 (3), 1945–46 (148,150).

[381]. 33.15.5. Farina, R. L. J. (to Jicwood Ltd.) **Improvements in or relating to synthetic resin adhesives.** *Brit. Patent* No. 559,590, Feb. 25, 1944. P.R.

A process for the cold hardening of a synthetic resin, comprising a primary condensation product of resorcinol and formaldehyde produced in the presence of a condensation catalyst and having a pH value of 4–5·5, which consists in the addition to such primary condensation product of a basic hydroxide in quantity to raise the pH of the mixture to at least 6·5 and thereafter allowing the mixture to harden at room temperature.

[382]. 33.15.5. Leicester, W. F. **Wood and glue: war-developed adhesives and gluing processes have many post-war applications.** *Sth. Lumberm.* 171 (2153), 1945 (275–6, 278–80).

A brief review of the various types of adhesive now in use and the purposes for which they are respectively best suited. Though the synthetic resins are likely to be increasingly used, the writer (President of the Casein Co. of America) is of opinion that casein will continue to be used for joints and lamination because of its ease in handling, tolerance of low setting temperatures and imperfect joints, and moderate pressure requirements.

[383]. 33.15.5. Sweatt, H. B. **What makes a strong glued joint?** *Sth. Lumberm.* 171 (2153), 1945 (287–8, 290).

A review of the uses, advantages and methods of application of animal glues. Properly prepared glue joints are capable of withstanding pressures of between 5,000 and 10,000 lb./sq. in. and will last almost indefinitely. The attainment of strong joints depends in large part on preparation of the wood. The densest woods glue best. The working moisture content should be such that when increased by the moisture from the glue, it will be as near as practicable to the average moisture content of the finished article in use. The amount of moisture added by animal glue varies from less than 1 per cent. in timber 1 in. thick to more than 45 per cent. in thin plywood. Careful machining of wood is necessary before gluing. Wood surfaces should be machined smooth, even and flat, and in panel work the piece should also be planed to uniform thickness. Tests conducted at the Forest Products Laboratories have proved that no material benefits result when the surfaces are roughened before gluing. In some species treatment of the wood, before gluing, with a 10-per-cent. solution of caustic soda has proved very effective in tests. Wood surfaces to be joined were brushed with this solution and after 10 minutes wiped dry with a cloth. A decided improvement was noted in joint strength of Hard Maple, Yellow Birch, White and Red Oak, Red Gum, Black Cherry. In one instance shear strength increased from 2,440 lb. to 3,564 lb.

[384]. 33.15.5. **Control of conditions in gluing with protein and starch glues.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1340, 1945. pp. 5 + plates + tbls. P.R.

Brief details of conditions to be observed in the production of perfect joints with protein and starch glues, with a table of pressure data on screw clamps and other devices used in the gluing, together with plates showing the results of satisfactory and unsatisfactory gluing conditions.

[385]. 33.15.5. Kohler, R. (to Henkel & Cie, G.m.b.H.). **Adhesive for wood and similar materials.** *German Patent* No. 741,030, Sept. 16, 1943. Chem. Abstr. 40, 1946 (502). P.R.

For joining wood or similar materials a mixture of starch or its products and melamine-aldehyde condensation product is used. The aldehyde of this condensation product is preferably CH_2O. The mixture contains less than 40 per cent. of the condensation product. The adhesive is made with water.

[386]. 33.15.5. **New resorcinol glue.** *W. Cst. Lumberm.* 72 (12), 1945 (122).

A note on 'Cascophen', a new resorcinol resin glue which can produce a boil-proof and durable phenol-resin-type bond at ordinary room temperatures, and is suitable for use on sawn surfaces or imperfectly fitting joints, provided that sufficient pressure is exerted.

[387]. 33.15.5. Villière, A. La colle Caurite et son utilisation dans les industries du bois. **[Caurite glue and its use in wood industries.]** *Ann. Éc. Eaux For. Nancy* 8 (2), 1942 (207–79). [F.] [Laboratoire Central d'Essais des Bois, Paris.]

After a fairly detailed account of the properties and methods of using Caurite (a urea-formaldehyde resin) for gluing, reports are given on tests made at the Laboratoire Central d'Essais des Bois on its use in both cold-setting and thermosetting adhesives, with various hardening and extending agents and in various forms. Particular attention has been given to methods of reducing to a minimum the quantities of Caurite necessary for making a satisfactory joint, and details and results are given of tests (1) on various mineral extenders, (2) on the use of the adhesive in the form of a foam. The first of these methods effected considerable economies and gave satisfactory joints, but must be used only in moderation, as it is very deleterious to the tools used in working the plywood subsequently. The use of the adhesive in the form of a foam was very satisfactory; it diminishes the quantity of resin used, can be used for the gluing of very thin veneers, and introduced very little water into the wood.

[388]. 33.15.5. Howes, D. E. **Engineering problems of dielectric heating.** With comments by H. A. Hands and E. C. Hathaway. *Rep. 5th Vermont Wood Prod. Conf.* 1945 (41–52). P.R.

The fundamental factors involved in dielectric heating are discussed.

[389]. 33.15.5. **A new process for bonding thermosetting plastics.** *Plastics* 9 (100), 1945 (420–2). P.R.

An account of a new process of bonding laminated or moulded products, developed by Bakelite Ltd., and said to be particularly applicable to laminated plastics and densified woods. The surface to be bonded is abraded in the presence of a solution of a special phenolic resin before the cold-setting cement is applied. Nominal failing shear stress only can be quoted because this shear stress decreases with an increase in overlap, and increases with an increase in thickness. Typical failures of various types of test piece are discussed and illustrated.

[390]. 33.15.5. **Metal bonding. Notes on the Redux process and some of its applications.** *Aut. Engr.* 35 (466), 1945 (354–6). L.S.

The Redux process, originally developed by Aero Research Ltd., Cambridge, can be used for bonding metal to metal, metal to wood or metal to a thermosetting plastic and produces a joint which is water-resistant and unaffected by immersion in petrol or oil. The article gives some notes on the process and its applications.

[391]. 33.15.5 : 12.26–8 : 31.27 : 33.36.3. Black, J. M., Olson, W. Z., and Bruce, H. D. **Effects of elevated curing temperatures on the strength and durability of Yellow Birch plywood joints made with room-temperature-setting urea glues.** *Rep. U. S. For. Prod. Lab., Madison* No. 1339, 1945. pp. 4 + tbls. P.R.

Yellow Birch plywood, made with five different kinds of urea glue, was cured at several different temperatures. Specimens were tested for initial dry- and wet-joint strength and were then exposed to various conditions of heat and moisture. The rate of deterioration was noted and an attempt was made to correlate it with the original curing temperature. Data obtained after the first year of exposure indicated that the temperature of curing within the range 80° F. to 250° F. had no important effect on original joint strength or durability. The results of dry and wet shear tests on specimens after exposure to various degrees of heat and moisture are given.

[392]. 33.15.5 (66.9). Nigeria. **Annual report on the forest administration of Nigeria for the period 1st January 1944 to 31st March 1945.** Govt. Printer, Lagos. 1945. pp. 47.

Graveyard and exposure tests of casein-bonded and urea-formaldehyde-bonded plywood at Ibadan, showed the great superiority of the synthetic resin glue. Casein-bonded plywood not only failed through the opening of the plies, but the glue appeared actually to attract insects. Fire-resistant pre-treatment had a bad effect on the strength of both glues. exposure tests of similar samples in the Northern Provinces show little deterioration except for weather staining and some slight opening of the casein-bonded plies (p. 16).

33.17. Sawmilling

[393]. 33.17. **Building a new sawmill to demonstrate new principles.** *Timberman* 46 (12), 1944–45 (48–49, 82).

Description of a demonstration portable sawmill designed and built by the Peters

Company of Portland, Ore. It consists of a number of independent steel frame sections, which, when linked together, form a strong all-steel saw floor. The mill can be set up on any one of several types of foundation, such as heavy logs, timber posts or concrete piers. The mill has been designed to operate with a crew of 14 men, and its capacity is expected to exceed 50,000 ft. in 8 hours when the crew is thoroughly familiar with the equipment. The demonstration mill is driven by electricity, but the plant could be operated by diesel power with equal efficiency.

[394]. 33.17 (66.4). EDWARDS, H. A. **Exploits of a British forestry company in West Africa.** *J. Land Agents' Soc.* 44 (12) 1945 (222–6).

The company started and ran two sawmills in Sierra Leone, mainly with native labour, to produce timber for service requirements. The mills were both 40 ft. in span and 120 ft. long and the machinery included 25-ft. steel-table-top, friction-drive rack benches capable of taking 72-in. saws and two reversible roller-feed push benches, 48 in. and 36 in., all driven from a pit-sunk countershaft. At one mill the power unit was a 40-h.p. twin-cylinder static steam engine, and at the other two 16-h.p. portable steam engines. As pole lorries were not available, army lorries were converted and adapted with the addition of a trailer. Power winches fitted to tractors were used for extracting trees from deep gorges and other inaccessible places. All trees over 2 ft. 5 in. in diameter were pit sawn, since the rack saw bench could not handle logs of greater dimensions. The lop and top was corded and burnt in shallow trenches for charcoal.

As the felling areas were cleared of timber, the local village headmen would be allowed to take a crop of hill rice, and in return would be responsible for supplying men to plant up the area under the supervision of the local Forest Officer. Nurseries were sown with selected seed from the forest, and the felled areas planted up as mixed forest.

[395]. 33.17 (931). **Interesting points on N.Z. sawmilling.** *Aust. Timb. J.* 11 (8), 1945 (354–5, 362). *Extr.* from Report of the Executive of the New Zealand Dominion Federated Sawmillers' Association.

New Zealand production in the year 1944–45, timber controls and prices, building activity, production costs and forest policy are commented upon. An advance in output of *Pinus radiata* is noted, and also an increased demand for the less common varieties of New Zealand woods, particularly Tawa [*Beilschmiedia tawa*].

[396]. 33.17 : 07.7. SLOSS, H. H. **Turning cordwood into dimension stock.** *J. For.* 44 (4), 1946 (292–3). [Vredenburgh Saw Mill Co., Vredenburgh, Ala.]

The Vredenburgh Saw Mill Co. has developed and patented a modified edger, which turns round logs into squared baulks in a single operation. The first of the two edgers feeds the log, resting on a chain with lugs and steadied on top by a circular walker, and removes two slabs. The second edger, which is of the conventional type, propelling with rollers, removes the remaining two slabs, producing the finished 4 × 4 or 4 × 6 in 5 seconds.

The apparatus is very simple, cheap, very portable, and operable by hand. It is capable of producing 5–6 thousand bd. ft. per hour from small lumber.

Small logs now worth $8 a cord will be worth $25 when turned into squared baulks, on the assumption that an average cord will produce about 600 bd. ft. worth $40 per 1,000 bd. ft. The cost of milling with this machine is about $2 per 1,000 bd. ft. and the cost of logging and hauling will be about the same as cordwood handling. An operator could afford to set up the machine for one acre of 6–8 cords and move two or three times a day, since the machine can remain on wheels.

To the forester this means that trees down to 6 in. d.b.h. have suddenly become merchantable.

[397]. 33.17 : 07.7 : 33.12. BUCKLEY, R. H. **Elements of four-cutter design.** *Timb. News* 54 (2081), 1946 (97–9).

There exists a graded range of four-cutter machines, designed to suit timbers up to 15 × 16 in. and over. Spindle speeds on small machines may be twice as high as on large ones, and, since the quality of the finish depends upon the number of cutter marks per in., larger machines must carry more cutters per head to obtain the same finish. Small machines are usually designed for 'single-point finish', i.e. one cutter only contributing to the finish on each section of the mould; this method is ideally suited for short or special runs. Larger machines, designed for jointing, are equally suitable for single-point finish, provided that the timber can withstand the feed roller loading and the added friction of a longer bed, etc. The design and working principles of 5 types of machine are described, and figures show various combinations of top, bottom, side and beading heads, used in producing planed, tongued-and-grooved planks and box boards.

[398]. 33.17 : 32.96 : 07.7. **Lorry loading tackle for the small mill.** *Timber News* 54 (2081), 1946 (99–100). [Forest Products Laboratory, Madison, Wis.]

An account of three types of loading tackle. Jacks housed in portable standards support a small log or metal beam over an inclined road bed. The rear bolster of the lorry engages the load as the lorry backs under it, and the front supports are then jacked down. In the lever-arm support the end of a log cross-piece is supported by the end of a plank which is pivoted to raise or lower the cross-piece. When the lorry is in position and a key-bolt removed, the plank is allowed to pivot under the weight of the load and the front corners of the load are lowered one after the other. The supporting log is then turned down toward the front end of the load until the load rests on the bolsters.

The gate-frame is a rectangular construction tilted slightly towards the mill and propped with a plank or else supported by a brace or by a small chain. The lorry roller engages under the load about a foot back from the front of the load and lifts it off the support as it backs. The lorry can be built with special rollers for use in conjunction with the folding frame.

[399]. 33.17 : 32.3 : 07.7. **New automatic sorting reduces piling costs.** *W. Cst. Lumberm.* 72 (12), 1945 (79–80, 115).

A description of a new green-chain sorter. The chain, set at right angles to the main mill transfer, requires only one grader, who can make 20 segregations by size, length and quality, and three pilers. The roll system used is described and illustrated.

[400]. 33.17 : 33.7 : 07.7. Parfenov, G. N. Sdvoennaya balansirnaya pila. **[Double rocking cross-cut saw.]** *Lesnaya Prom.* No. 9, 1945 (9–10). [Russ.]

The arrangement described and figured is for cross-cutting large logs up to 80 cm. in diam. into short fuelwood or blocks for gas generators; it consists of two electrically operated rocking cross-cut saws mounted one above ground and brought down into the cutting position by a hand lever, the other in a pit and operated by a pedal. Where there is sufficient power for only one saw at a time, the upper saw is first used to cross-cut to rather more than half the thickness of the log and is then released while the lower saw, in direct alignment, completes the cut from underneath. If both saws can be operated at once, their alignment is altered to the length of the material to be cut; the upper saw is then used above for the first half-cut, but subsequently both are used simultaneously, the lower completing the previous half-cut while the upper makes a fresh one. The method eliminates the necessity for turning large logs in order to make a complete cross-cut.

33.3. *Chemical Treatment*

[401]. 33.3. Stamm, A. J. **Chemical utilization of wood: its opportunities and obstacles.** *J. For.* 44 (4), 1946 (258–65). [U.S. Forest Products Laboratory, Madison.]

A comprehensive review of work done at the Forest Products Laboratory, Madison, on chemical utilization of wood, covering pulping, extraction, hydrolysis, destructive distillation, reactions with other chemicals, and chemical treatment to improve the properties of wood. The author points out that no universally successful method of utilizing inferior and waste wood has yet been discovered. One unsolved problem is that of cheap transport of large quantities of waste to processing plants. [See also *Mimeo U.S. For. Prod. Lab., Madison,* No. *R*1601, 1945.]

[402]. 33.3 : 34.6 : 11.47.1 : 31.3. Seiberlich, J. **Fundamentals of lignin chemistry as applied to fertilizers.** With discussion. *Bull. Ntheast. Wood Utiliz. Coun.* No. 7, 1945 (49–55). P.R.

The chemical and physical properties of isolated lignin, so far as they are known, are discussed and compared with those of unaltered lignins in the living plant.

Lignin in fresh plant tissues may be partly decomposed by higher fungi, but once lignin is isolated it becomes resistant to attack even by these organisms. The colloidal aspects of isolated lignins deserve more attention, and studies of such properties as absorption, acidity, and moisture content may well help in developing a humus-forming material which at the same time carries special agents acting as fertilizers.

[403]. 33.3 : 34.6. Gault, H., and Hiong, K. W. Obtention de masses d'épuration des eaux dures à partir de la lignine technique, sous-produit de la saccharification du bois. **[The production of a softening agent for hard water from lignin, by-product of wood saccharification.]** *C.R. Acad. Sci., Paris* 220 (17), 1945 (608–9). [F.] D.S.I.R.

The lignin residue from the saccharification of wood can be transformed by the action of concentrated sulphuric acid into an agent for softening water. A brief account of the method of producing, and using the substance is given.

[404]. 33.3 : 34.6 : 31.3. Suida, H., and Prey, V. Über den Aufschluss von Säure-Lignin. **[The decomposition of acid-lignin.]** *Ber. dtsch. chem. Ges.* 74 (12), 1941 (1916–25). [G.] P.R.

An account of experiments undertaken with the object of decomposing acid-lignin into substances of simpler molecular composition. Acid-lignin was heated with water and methanol to various temperatures. The presence of water was found to aid thermal decomposition at 300°. Water alone was found to be less effective. The products were phenols, acids and neutral substances. A further attempt was made to decompose the residue of lignin with mixtures of acids and bases. The addition of acids increased the production of substances of high molecular weight. The use of sodium hydroxide with methanol at 200° was effective, but much gas was formed and the products showed a low methoxyl content and were of high molecular weight. A further distillation gave only a small yield of substances of low molecular weight. The use of calcium hydroxide with methanol gave, at about 300°, an almost complete transformation into substances of low molecular weight. Water used instead of alcohol produced substances of high molecular weight. After neutralization and distillation of solvents, etc., 60 per cent. of the product was found to be of low molecular weight and to be soluble in ether, but high molecular combinations still remained. Heating of the crude tar in alcohol with sodium hydroxide resulted in a further disintegration of substances of high molecular weight. The final neutralization was made with carbon dioxide.

[405]. 33.3 : 34.6 : 31.3. Brookbank, E. B. **Industrial uses of alkali lignin.** *Paper Tr. J.* 122 (13), 1946 (44–6). P.R.

Alkali lignin has been extensively studied as an ingredient of thermo-setting phenolic resin compounds. Various methods for incorporation of the lignin into the resin have been studied, but, with few exceptions, all efforts have resulted in a small but definite decrease in the quality of the finished product, without materially reducing cost. This lignin is extensively used as the organic expander in the negative plates of lead-acid storage batteries. To-day, the majority of the automobile batteries manufactured in the United States use this material, with marked success. It has been used successfully for the preparation of asphalt emulsions, and when added to high-melting asphalts in small amounts, materially reduces cold flow. Many other possible uses for alkali lignin have been explored or are in course of development, e.g. in printing inks, as a carrier for insecticides, as a means of conditioning boiler water for the prevention of scale and caustic embrittlement, and as a medium for removing iron from water supplies. *From author's summary.*

[406]. 33.3 : 34.6 : 31.43. Voss, W., and Ringel, J. (to I.G. Farbenindustrie. A.G.). **Utilization of sulfite liquor from deciduous trees.** *German Patent* No. 742,147, Oct. 14, 1943. Chem. Abstr. 40, 1946 (466). P.R.

The liquor is concentrated and the lignosulphonic acid, or the greater part of it, is precipitated with a neutral salt. The precipitate is removed and the filtrate is heated for a short time under pressure without adding mineral acid. Furfural is formed, and is recovered by steam distillation. This process is particularly suitable for sulphite liquor from Beechwood.

[407]. 33.3 : 34.6. Hatch, R. S. **Magnesium base sulphite pulping.** *Paper Tr. J.* 122 (11), 1946 (54–6). P.R.

This paper describes possible methods of disposing of or utilizing the organic solids in sulphite waste liquor. The cyclic process which depends upon change of base from calcium to magnesium is outlined. The magnesium-base waste liquor is evaporated and burned, and the caustic magnesia, which forms the main portion of the resulting ash, is collected from the flue gases, made into a slurry, and advantageously used to absorb the SO_2 in the flue gases to form fresh cooking liquor. Modifications of the cooking process leading to greater steam economy, chemical engineering problems involved, and expected savings in sulphur and base are described. *From author's summary.* [Cf. *For. Abstr.* 8 (Nos. 437, 524).]

[408]. 33.3 : 34.6 : 33.32.4. BERGSTROM, H. O. V., CEDERQUIST, K. N., and TROBECK, K. G. **Products from cellulosic materials.** *Swed. Patent* No. 100,762, Jan. 28, 1941. Chem. Abstr. 40, 1946 (736). P.R.

Wood or other cellulosic material is freed from pentosans, finely ground, and then converted to glucose. The residue containing the lignin is used for making moulding compositions. The pentosans are removed by means of 0·5 per cent. H_2SO_4 and the solution obtained is then heated to distil off furfural. [Cf. *For. Abstr.* 8 (No. 449).]

[409]. 33.3 : 34.6 : 34.26. BERGIUS, F. (to Dtsche. Bergius A.G. für Holzhydrolyse). **Utilization of wood decomposition residues.** *German Patent* No. 743,452, Nov. 4, 1943. Chem. Abstr. 40, 1946 (738). P.R.

For recovery of the resins contained in the residues from HCl-decomposed wood, a hot solvent or mixture of solvents for these resins is used. The solvent or solvents are resistant to, and immiscible with HCl. Its boiling point is above that of HCl still remaining in the residue. This solvent is circulated through the residue until it becomes sufficiently enriched with extended resins.

33.32. Pulp and Paper Manufacture. Wallboards. Plastics

[410]. 33.32. GRAFF, J. H. **The Wilson stain: for identification of papermaking fibres.** *Paper Ind.* 27 (9), 1945 (1363). P.R.

In the Wilson stain, cadmium iodide is used in place of the usual potassium iodide, and formaldehyde is used as it has a stabilizing action and improves the brilliancy of colours and also prevents their overlapping. The colour reactions of wood pulp to the Wilson stain are compared with those of C stain. In general the colour reactions of the Wilson stain are practically the same as those for the C stain.

[411]. 33.32 (47.0). IZVEKOV, A. **Soviet paper and cellulose industry.** *Pulp. Paper Mag. Can.* 46 (13), 1945 (1034).

A brief account is given of the losses caused to the Soviet cellulose and wood-pulp industry by the destruction of mills in regions occupied by the enemy.

[412]. 33.32 (485 : 73) : 35. Cellulosa- och trämassemarknaderna. **[The chemical and groundwood pulp markets.]** *Skogen* 33 (8), 1946 (127). [Sw.] USA höjer priserna på pappersmassa. **[The U.S.A. raises prices for paper pulp.]** *Skogen* 33 (9), 1946 (155). [Sw.]

Swedish exports of chemical pulp in 1945 were about 1,400,000 metric tons, and deliveries for domestic consumption about 150,000, the latter being almost treble the average pre-war figure. By the turn of the year, stocks had been reduced to 350,000 metric tons and by 1 Feb. 1946, when about 750,000 had been delivered to the U.S.A., were down to 300,000. OPA ceiling prices, however, are regarded as unsatisfactory, especially for bleached pulp, and if there is no improvement in prices, Swedish exports of pulp to the U.S.A. are likely to drop to a fraction of the normal. The British Paper Control bought in 1944–45 about 550,000 metric tons of chemical and groundwood pulp, which is to be delivered in the first half of 1946; considerable quantities have also been earmarked for the latter half of the year, but prices remain to be fixed by agreement between the two countries. Similar conditions hold for exports to France. Italy is to receive 44,000 metric tons of viscose pulp and 15,000 of paper pulp. Contracts for and reservations of groundwood pulp practically cover the expected production for the year. Only small quantities of this product are shipped to the U.S.A.

The second note states that OPA has raised pulp prices and secured a reduction of the U.S. freight charges borne by the exporter. For unbleached kraft and sulphite pulps the prices are still regarded as unsatisfactory from the Swedish point of view, but should render possible the resumption of exports of these products. For bleached kraft and sulphite pulps the new prices are still inadequate to justify exports to the U.S.A. The question of price increases has been so long under discussion that, owing to sales to other markets and a heavy reduction in stocks, it is now regarded as impossible for Sweden to ship the 700,000 tons of pulp previously envisaged as the year's quota for the U.S. market. Owing to fuel difficulties the Swedish chemical pulp industry will be able to reach at most 65–70 per cent. of its capacity in 1946, which should mean a total production for the year of at most 1½ million tons.

[413]. 33.32 (67.5). WILDEMAN, É. DE. Pâtes à papier: exploitations forestières tropicales. **[Pulp for paper-making: exploitation of tropical forests.]** *Rev. int. Prod. colon.* 21 (198), 1946 (30–2). [F.]

The writer discusses recent suggestions for using forest species from the Belgian Congo for paper-making [see *For. Abstr.* 7 (No. 1303)], and argues that before this can be done, it would be necessary to experiment with the use of mixed pulps, since tropical species seldom grow in pure stands. It is necessary to look for plants which are easy to cultivate and inexpensive to raise and harvest; indigenous or acclimatized plants which are at present periodically destroyed (e.g. bush species which are annually burned); waste products of agriculture or industry.

[414]. 33.32 (71). SIBLEY, C. L. **Revolutionary changes on way in Canadian pulp and paper industry.** *Paper Tr. J.* 122 (9), 1946 (60–74). P.R.

A general survey of the Candian pulp and paper industry in 1945. The wood supply and labour problems are discussed. The war has given an impetus to the production of chemical pulp and new enterprises are being undertaken, centred mainly in stands of Spruce, Balsam and Jack Pine in northern Ontario, and especially on the northern shore of Lake Superior. The situation and prospects of the newsprint industry, prices and profits of pulp and paper companies, domestic consumption, pulp production and exports and developments in forest conservation are all dealt with. A list of the more important new developments in the industry in Canada is given.

[415]. 33.32 (71) : 06.2. CANADA. **Twenty-sixth annual meeting proceedings, 1944.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 746 (H–2), [1944?]. pp. 59.

[416]. 33.32 (71) : 06.2. CANADA. **Twenty-seventh annual meeting proceedings, 1945.** Canadian Pulp and Paper Association (Woodlands Section), Montreal. *Index* No. 817 (H–2) [1945?]. pp. 36.

[417]. 33.32 (72). **Mexican paper industry.** *Pulp Paper Mag. Can.* 46 (13), 1945 (1042). From *World's Paper Trade Review.*

A short review of progress in the Mexican paper industry. Mention is made of a new process in use at San Rafael whereby pulps are hydrated individually before mixing. A new kraft mill with a continuous cooking process is being installed at San Rafael.

[418]. 33.32 (73). STEVENSON, L. T. **How and why the Southern pulp and paper industry leads the nation.** *Sth. Pulp Paper J.* 8 (5), 1945 (83–5).

An account of the development of wood-pulp production in the Southern region of the United States, which rose from 16·4 per cent. of the total United States wood-pulp production in 1930 to 40·3 per cent. in 1940, and since 1940 has exceeded that of any country outside the United States. Tables give comparisons of regional receipts of pulpwood in the United States and ratios of the Southern to the total United States production in wood pulp and in paper and paperboard production, etc.; and estimates for 1945.

[419]. 33.32 (73) : 07.2. CHIDESTER, G. H. **Facilities for pulp and paper research at the U.S. Forest Products Laboratory, Madison 5, Wisconsin.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1499, 1945. pp. 9 + plates. P.R.

[420]. 33.32 (73) : 35 : 09.4. DOBROW, M. C. **Paper industry heading for record year.** *Paper Tr. J.* 122 (9), 1946 (43–5, 57). P.R.

Statistics are given, showing the capacity and actual production of paper machines in the United States for the years 1917 to 1945 inclusive, and also the United States supply, consumption and exports of wood pulp for 1944 and 1945, together with an estimate for the first six months of 1946.

[421]. 33.32 (73) : 35 : 09.4. SWANSON, O. F. **Heavy wood pulp demand exceeds notably high 1945 output.** *Paper Tr. J.* 122 (9), 1946 (76–82). P.R.

The shortage of wood pulp in the United States is discussed. A graph shows the total United States production of wood pulp and paper with the new supply, consumption, imports and exports of wood pulp from 1900 to 1945 inclusive.

[422]. 33.32 (73) : 09.4. WHITING, G. **Paperboard industry sets up five years of record production.** *Paper Tr. J.* 122 (9), 1946 (46–50). P.R.

Statistics for the United States paperboard industry for the years 1943, 1944 and 1945 are given. These include comparisons of the receipt of orders and production in their fulfilment, production in average weekly tons, monthly average percentages of activity in mills, average monthly tons of American wood pulp for the domestic market, and inventories of purchased pulp and waste paper.

[423]. 33.32 (73). **American woods for paper making.** *Tech. Note. U.S. For. Prod. Lab., Madison.* No. 212, 1946. pp. [4]. P.R.

A summary of the principal woods used in the United States for paper making, and the processes best suited to them.

[424]. 33.32 (73). MACDONALD, R. G. **Hardwoods for groundwood pulp.** *Bull. tech. Ass. Pulp Pap. Ind.* No. 60, 1945. [1–2]. P.R.

The article deals with the growing necessity for United States pulping mills to use locally grown hardwoods, because of the increasing shortage of pulpwood. Since the war Aspen and Birch groundwood pulp has been used for various types of paper. The difficulties of grinding hardwoods, and modifications in mill equipment are discussed. Lower-density hardwoods, e.g. Cottonwood, Aspen and Willow, produce a fairly free pulp with moderately good strength, although it has probably a lower fibre length than pulp from Spruce ground under the same conditions. Higher-density hardwoods give a higher yield of groundwood than the lower-density ones, but the pulp is less strong because the fibres are reduced to very fine particles. Steaming, boiling water, or chemical pre-treatment of these woods are thought to help in this respect.

[425]. 33.32 : 12.26–8 (59.5). HILL, E. L. **Meranti wood from Malaya as a source of paper pulp.** *Bull. imp. Inst., Lond.* 43 (4), 1945 (265–74).

The four species of young Meranti woods under examination (*Shorea leprosula*, *S. acuminata*, *S. parvifolia* and *S. bracteolata*) are similar in their properties; they are all short-fibred woods with an average fibre length of about 1 mm. The present report shows that technically it would be possible to manufacture bleached pulps from Meranti thinnings, but further research would be necessary to show whether it would be economically practicable in Malaya. *From author's summary.*

33.32.1. *Pulp Manufacture*

[426]. 33.32.1. BOIJA, J. A. **Defibering wood chips by a wet process.** *Norw. Patent* No. 65,849, March 1, 1943. Chem. Abstr. 40 (5), 1946 (1316). P.R.

Wood chips are introduced into the top of an open boiler which is normally kept full of chips, and steam is introduced from below. The chips are continuously withdrawn from the bottom of the boiler and passed directly to the defibering plant. Apparatus is described.

[427]. 33.32.1. PER FADUM. **Continuous digestion of cellulose.** *Norw. Patent* No. 67,868, May 22, 1944. Chem. Abstr. 40 (5), 1946 (1316). P.R.

Wood chips are impregnated with the cooking liquor and the digestion is completed without addition of liquor in excess of that taken up by the chips. The chips are preferably passed continuously through a tall vertical digester from below, and only sufficient liquor is contained at the bottom of the digester to impregnate the chips. The chips are directly or indirectly heated on leaving the liquor and during their continuous movement towards the top of the digester, where they are discharged. A suitable apparatus is described.

[428]. 33.32.1. HAFFNER, F., and SCHLECHTER, H. (to Probst and Class). **Disintegration of wood.** *Ger. Patent* No. 745,251, Dec. 2, 1943. Chem. Abstr. 40 (7), 1946 (2002). P.R.

Comminuted wood, suspended in H_2O, is disintegrated in a vibratory colloid mill whereby it is separated into fibre freed of extraneous matter and the extraneous matter itself. The mechanical action of the colloid mill is augmented by the chemical action of suitable substances. The fibrous matter freed of extraneous substances is used for preparing feed.

[429]. 33.32.1. McKee, R. H. **Recovery of cellulose and lignin.** *Brit. Patent* Nos. 560,492, April 6, 1944. Chem. Abstr. 40, 1946 (1655). P.R.

Wood pulp is produced and lignin is recovered in its natural state by digesting wood in a reagent consisting of an aqueous solution of a readily soluble salt of an aromatic acid derived from a single benzene ring, e.g. an alkali-forming metal salt of benzoic acid, salicylic acid or an aromatic sulphuric acid derived from a single benzene ring.

[430]. 33.32.1. Haney, C. I., Martin, M. E., and McGoury, T. E. (to Celanese Corp. of America). **Pulp manufacture for acetylation.** *U.S. Patent* No. 2,389,195, Nov. 20, 1945. Chem. Abstr. 40, 1946 (1656). P.R.

Wood pulp suitable for the production of cellulose esters may be prepared by cooking the wood with AcOH or other lower aliphatic acid at temperatures from 130° to 220° for 1 to 10 hours. The further purification of the pulp is such that the acyl groups introduced during the pulping operation are not removed. Thus, 20 parts (by weight) of oven-dry Black Spruce sawdust and 125 parts glacial acetic acid are heated five hours at 180°; the resulting pulp is boiled twice with the acid and is washed with progressively weaker acid and then with H_2O. The neutral pulp is chlorinated for 30 minutes with 10 per cent. excess Cl and then bleached for three hours at 35° with NaOCl (1 per cent. available Cl). The pulp has an acetyl value of 15 per cent. In place of acetic acid, propionic or butyric acid, or mixtures of these acids with acetic acid or with each other, may be used. In addition to being suitable for further acetylation, the pulp is valuable as a paper-making material, either alone or mixed with other fibres.

[431]. 33.32.1. McKinney, J. W. **The effect of alkaline pulping on the acetylating properties of wood pulp.** *Paper Tr. J.* 122 (4), 1946 (58–62). P.R.

The modifications in kraft cooking procedure studied included low-temperature cooking, variations in the sulphidity of the cooking, and alkaline pre-treatment of the chips. No improvement in acetylation clarity resulted from the application of these methods. A mild pre-cooking with sulphite cooking acid or with dilute sulphuric acid, however, resulted in a great reduction in the amount of haze. When the sequence was reversed, with the sulphite cooking following the kraft cooking, there was no improvement in clarity. In order to determine whether haze-producing substances were formed from cellulose itself under alkaline pulping conditions, relatively pure cellulose in the form of cotton linters was cooked with kraft liquor under conditions substantially the same as those used for wood. No increase in haze was noted. A possible explanation of these facts in the formation of anhydrohemicelluloses during an alkaline cooking is advanced.

[432]. 33.32.1. Vincent, R. **The sulphite process—its position in chemical and paper fields today.** *Paper Tr. J.* 122 (9), 1946 (136–42). P.R.

A statistical review of sulphite pulp production indicates that sulphite pulps are not yet being heavily replaced by bleached sulphate production. The problem of the sulphite integrated mill is paramount and several directions for a possible solution are indicated. The position of sulphite pulp in the chemical converting field, is, as yet, unchallenged. The future of the sulphite process is dependent upon the solution of the wood and recovery problems. *Author's summary.* [Cf. *For. Abstr.* 8 (No. 407).]

[433]. 33.32.1. Wise, L. E., Murphy, M., and d'Addieco, A. A. **Chlorite holocellulose, its fractionation and bearing on summative wood analysis and on studies on the hemicelluloses.** *Paper Tr. J.* 122 (2), 1946 (35–43). P.R.

A critical review is given of the methods used in the isolation of holocellulose from wood. Special emphasis is placed on experiments simplifying and otherwise modifying the sodium-chlorite procedure of Jayme. In the case of conifers, the holocellulose obtained by treatment with acetic acid and sodium chlorite could be separated into hemicellulose fractions and alpha-cellulose. These techniques are fully described. The sum of the percentages of ash, acetyl extractives, lignin, the hemicellulose and alpha-cellulose in a coniferous wood accounts for 98 to 102 per cent. of the original wood sample. Summations within this range are considered entirely satisfactory. When applied to hardwoods, the summations appear to be somewhat less satisfactory. Studies on Spruce, Redwood, Douglas Fir and

Aspen are reported and more comprehensive data are given for Ponderosa Pine, which serves to exemplify analyses of other coniferous woods. In the case of Ponderosa Pine, summative analyses were also made by determining ash, extractives, alpha-cellulose (corrected for its various components), mannan, xylan, uronic anhydride, lignin and acetyl groups. The two sets of summations are in substantial agreement. The errors inherent in all types of summative wood analyses are discussed and special reference is made to possible balanced errors, which may have accounted for the apparent precision of such analyses in the past. The chief value of the chlorite method for holocellulose, is for research. Large-scale preparations can be made easily within very short periods with the minimum of manipulation. Such preparations (because of the mild action of chlorine dioxide) can serve in the further study of alpha-cellulose fractions, hemicelluloses, and pectic materials. They may also prove valuable in researches on the degree of polymerization of the various carbohydrate fractions. When unbleached pulps are chlorited, they give raw materials from which residual hemicelluloses may also be removed quantitatively and studied. *Authors' summary.*

[434]. 33.32.1. VINCENT, R. **The importance of hemicellulose in wood pulp.** *Paper Tr. J.* 122 (4), 1946 (53–7). P.R.

The chemistry of hemicellulose and its relationship with the other constituents of wood is discussed. The commercial procedures remove much of the hemicellulose from the pulp although it is indicated that its presence aids hydration of the pulp during stock preparation. A new process has been developed lately by which lignin is removed without affecting the other carbohydrates present and, since the holocellulose so obtained contains hemicellulose, it is to be expected that new pulps will be produced. *Author's summary.*

[435]. 33.32.1. BORLEW, P. B., and PASCOE, T. A. **Potentiometric determination of sodium sulphide in sulphate pulp black liquor.** *Paper Tr. J.* 122 (10), 1946 (31–4).

The high-sodium-glass electrode can be successfully employed for argentimetric determinations of inorganic monosulphide if the concentration of S-ions in the half-cell is 0·01 normal or better. The data are confirmed by the carbon-dioxide evolumetric method of the authors. The potentiometric method described permits a rapid and direct determination of the Na_2S content in sulphate black liquor without interference from organic sulphides and other substances usually present. Samples of sulphate black liquor can be stored without decomposition in the absence of air and under low temperature conditions. The consumption of Na_2S in kraft cookings reaches a maximum in a comparatively early stage of the cooking and practically ceases from then on. The Na_2S consumption appears to be a relatively small part of the amount charged. In combination with the known method of argentimetric titration of mercaptans the described potentiometric method permits the successive determination of inorganic monosulphide and mercaptans. This procedure, if applied to the analysis of kraft mill sewer effluent, may contribute to study of the problem of river pollution and its toxicity to fish life.

[436]. 33.32.1 : 33.15.3. KHUKHRYANSKI, P. N. Spressovannaya drevesina dlya proizvodstva tsellyulozy̆. **[Compressed wood for chemical pulp manufacture.]** *Lesnaya Prom.* No. 9, 1945 (14–7). [Russ.]

From the evidence so far available it seems that the use of compressed wood for chemical pulping would give: (1) A considerable increase (2–3 times) in the charge of chips, and thus in the output, per digester. (2) More rapid cooking, on account of more rapid penetration of the swelling chips by the cooking acid. (3) A proportionally smaller expenditure of cooking acid. (4) Better supplies of raw material through wider use of Pine for the pulp industry. (5) Improved conditions for utilization of waste liquors, owing to their higher concentration. (6) The possibility of obtaining additional by-products by treatment of the resinous liquid removed from the wood during compression.

Of the methods available for compressing wood the best for this purpose appears to be Khukhryanski's, in which the wood is first steamed at a steam temperature of 100–110° C. (giving 80–90° within the wood) and held while setting at 60–80°, giving a final moisture near fibre-saturation point, which renders the material suitable for chipping. Chemical and mechanical tests of wood subjected to this relatively mild treatment do not suggest that the quality of the pulp made from it would be impaired.

[437]. 33.32.1 (43.1–5) : 34.6. HILL, A. C., and CAMPBELL, W. B. **Aschaffenburger Zellstoff A.G., Aschaffenburg Mill, Aschaffenburg, Hessen.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 49, Item No. 22 [1945?]. pp. 10. P.R.

A description of the Aschaffenburg mill, which was engaged in the manufacture of sulphite pulp from Spruce. Temperature schedules for glassine and greaseproof pulps, and for pulp for crepe paper, sulphite wrapping and other paper grades are given. The utilization of waste liquor for alcohol production is described. The waste from the alcohol plant was used for conversion elsewhere into tanning liquors. Reports show wood, limestone and sulphur consumption for one month, and examples of control sheets of the digester operation are included.

[438]. 33.32.1 : 07.7 (485). EVANS, J. **Kanto knot separator.** *Pulp Paper Mag. Can.* 46 (13), 1945 (1003).

The Kanto Knot Separator (figured) is an apparatus for chip-sorting, and consists of an inclined plane, over which chips are allowed to pass and fall into two receptacles, the greater weight of the poorer chips containing knots carrying them into the farther receptacle. The effect is increased by suction applied to the plane's lower edge. The secondary chips provide a secondary pulp, the properties of which are compared with those of the primary pulp.

33.32.3. *Wallboards, Fibreboards, etc.*

See also *For. Abstr.* 8 (No. 351).

[439]. 33.32.3. LINZELL, H. K. (to U.S. Gypsum Co.). **Compressed fibre products.** *U.S. Patent* No. 2,388,487, Nov. 6, 1945. Chem. Abstr. 40 (5), 1946 (1300). P.R.

Ligno-cellulosic materials are compressed above 35° F. in the presence of ferric compounds and preferably also the usual sizes and oils, to give consolidated boards, etc., of improved strength and H_2O-resistance in less time than formerly. $FeSO_4$ may be sprayed on the finely divided dry fibres, added to pulp, or applied to solid wood by impregnation.

[440]. 33.32.3 (43.1–5) : 33.15.4. HUTCHEON, N. B. **Interview with Dr. Barchfeld, chemist at Dynamit A.G. at Troisdorf, 14th September, 1945.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 61, Item No. 22 [1945?]. pp. 11. P.R.

A method of making fibre boards from waste fibres without any added binder is described. Such boards can be rendered water-repellent by heating to just below the charring point. Data are given on the physical properties of these materials, called Tronal, when prepared in various ways. Information is also given on the preparation, use and properties of Dynal, a phenol-resin-bonded, laminated, paper product, used principally for aircraft sheets. The paper used for Dynal had the resin incorporated in it in the papermaking process and requires no dipping. Limited information was obtained on the use of Tronal as a substitute for Balsa wood in aircraft construction. *From author's summary.*

[441]. 33.32.3 (485). **Swedish wallboard industry.** *Pulp Paper Mag. Can.* 46 (13), 1945 (1037–8). From *World's Paper Trade Review.*

The growth of the Swedish wallboard industry since its inception in 1929 is briefly reviewed. The present capacity of the mills (most of which are run in connexion with sawmills or other wood-working establishments) is now estimated at 250,000 tons a year; although this capacity cannot be fully utilized at present.

33.32.4. *Plastics*

[442]. 33.32.4. GOLDSTEIN, P., and GILLETTE, H. R. (to Federal Eelectric Co. Inc.). **Fibrous thermoplastic product.** *U.S. Patent* No. 2,376,687, May 22, 1945. Chem. Abstr. 40, 1946 (208). P.R.

A Pine-wood resin (I)-treated paper-pulp, containing a modifier (II), is cured by heat and pressure to form a sheet with low water absorption and good laminating properties. (I) is a solvent-insoluble fraction of Pinewood pitch, sold commercially as 'Vinsol', and (II) is either ZnO or CaO. Forty lb. of kraft pulp is beaten with 50 lb. of (I) and 6·25 lb. of (II), together with some wetting agent, and then sheeted and dried, preferably to a 4- to 7-per-cent. moisture content. Further (II) is dusted on the surface of the sheet, which is then subjected to a pressure of 800–825 lb. per sq. in. at 275° F. for about 15 minutes.

[443]. 33.32.4. Bers, S. J. (to Armstrong Cork Co.). **Alcohol-insoluble zein molding plastics.** *U.S. Patent* No. 2,385,679, Sept. 25, 1945. Chem. Abstr. 40, 1946 (243). P.R.

Paraformaldehyde (I) and the gasoline-insoluble fraction (II) of Pine-wood resin are blended with the zein (III) in the approximate ratio of 5 : 33 : 67 and moulded at 4,000 lb. per sq. in. at 150° for 5 minutes to produce a tough, dark product which is only slightly swelled after a 48-hour immersion in 80 per cent. EtOH. An inert filler, e.g. wood flour, is first mixed with the (II) and (III) and pre-heated at 130° at atmospheric pressure to make a dry crumbly mass, which is then broken up and mixed with (I) and a lubricant, e.g. zinc stearate. The compounded mixture is then moulded as before. When Redwood flour is used it is desirable to age the finished moulded pieces for 48 hours at 140° and atmospheric pressure to improve the EtOH resistance.

[444]. 33.32.4. Navikas, V. A. (to Armstrong Cork Co.). **Zein molding compositions and method of molding.** *U.S. Patent* No. 2,385,721, Sept. 25, 1945. Chem. Abstr. 40, 1946 (243). P.R.

Description of a modified zein moulding composition (I) which, although thermoplastic, may be removed from the mould without significant cooling. (I) is precipitated by blending zein (II) 75, gasoline-insoluble fraction (III) of Pine-wood resin 25, wood flour 30, and calcium stearate 1·5 parts by weight. Moulding is at 275–300° F. for 1 minute. The ratio of (II) to (III) may be in the range from 3 : 1 to 2 : 1.

[445]. 33.32.4. Navikas, V. A. (to Armstrong Cork Co.). **Zein molding compositions.** *U.S. Patent* No. 2,385,722, Sept. 25, 1945. Chem. Abstr. 40, 1946 (243). P.R.

These compositions are similar in properties to those covered in U.S. Patent 2,385,721 [cf. preceding abstract]. A 3 : 1 mixture of zein and the gasoline-insoluble fraction of Pine-wood resin is blended in a ball mill at room temperature. The mixed powder (1 part) is added to a kraft paper pulp (3 parts), beaten and sheeted without calendering. The felt so formed is dried to approximately 10 per cent. H_2O, cut into suitable shapes, and moulded at 250–300° F. and about 8,000 lb. per sq. in. for 2 minutes to yield a highly finished hard product. No cooling of the mould is necessary prior to removal of the moulding.

[446]. 33.32.4 : 01.6. Nicholls, R. V. V. [Compiler]. **A bibliography of plastics derived from wood, plastics used in paper products, plastics for paper mills.** [McGill University, Montreal?] 1943. pp. 13.

[447]. 33.32.4 : 12.25. Lewis, H. F. (to the Pacific Lumber Co.). **Moulding powder from Redwood.** *U.S. Patent* No. 2,392,162, Jan. 1, 1946. Chem. Abstr. 40 (5), 1946 (1353). P.R.

The process consists in subjecting Redwood to a heat treatment in the presence of steam at a pressure of 500 to 800 lb. per sq. in. for a period of 10 to 12 seconds, disintegrating the Redwood and drying the disintegrated Redwood with the cooking liquor formed by the steam treatment. Pine-wood pitch may be added to the dried product. A moulding powder of improved flow results.

[448]. 33.32.4. Lewis, H. F. (to the Pacific Lumber Co.). **Moulding powder from tannin-containing woods.** *U.S. Patent* No. 2,392,163, Jan. 1, 1946. Chem. Abstr. 40 (5), 1946 (1353). P.R.

The process of U.S. Patent No. 2,392,162 is applied to tanning-containing woods [cf. preceding abstract].

[449]. 33.32.4 : 34.6. Los materiales plásticos y los residuos de madera. **[Plastic materials and wood waste.]** *Maderil* 17 (204), 1945 (11–2, 21). [Span.]

A review of some recent developments, chiefly American, in the utilization of wood waste in the plastics industry. Special reference is made to non-fibrous, lignin-base plastic materials, materials made from compressed sawdust without the use of a binder, lignin resins, and gelatinized wood. Before being compressed, gelatinized wood is in the form of a paste which can easily be coloured to produce, on hardening, materials of various shades having a modulus of rupture of 1,000–1,400 kg. per sq. cm.—roughly double the modulus of rupture of ordinary seasoned wood. One of the characteristics of this material is its relatively high modulus of elasticity, which may be as much as 1,400,000 kg. per sq. cm. or more. The density varies between 1·3 and 1·5 kg. per sq. cm. A table showing the density, resistance to rupture and modulus of elasticity of various plastic materials is appended.

33.33. Manufacture of Textiles from Wood

[450]. 33.33 : 35. **Wood pulp and cellulose supplies for rayon. Future output may be bigger—but other industries will also want to buy.** *Silk and Rayon*, Jan., 1946 (33–4). L.S.

A general review of present world supplies of wood pulp and cellulose, and the amount of cellulose likely to be available for British rayon manufacturers. The article discusses potential supplies of wood pulp for the United Kingdom from the Scandinavian countries and Poland, and the probable influences on world markets of the demands of other countries and other industries, particularly paper and plastics. Other possible sources of supply for the world market are mentioned. The potentialities of Canada are discussed in some detail. The best and nearest source of wood pulp for the British market is thought to be Newfoundland. Tabulated statistics show export proportions of wood pulp from leading countries in 1913, 1938 and 1939. The future output of other materials yielding cellulose for synthetic fibres may be much increased but new enterprises are likely to compete with the rayon industry.

33.34. Dyeing and Bleaching of Wood

[451]. 33.34. Black, C. K. (to E. I. du Pont de Nemours & Co.). **Colouring wood by pigment impregnation.** *U.S. Patent* No. 2,391,613, Dec. 25, 1945. Chem. Abstr. 40 (5), 1946 (1300). P.R.

Wood is immersed under pressure at 63–93° in an alkaline solution (pH less than 11·4) containing a stabilized diazo salt of any primary arylamine and a coupling component, such as hydroxy or amino aryl compounds or arylides of acetoacetic acid; both components are free of water-solubilizing groups. After impregnation the wood is treated with acid until neutral or slightly acidic. Examples are given in which yellow, orange, red, and blue coloration is obtained.

33.36. Preservation of Wood. Seasoning and Drying

[452]. 33.36. Wilson, M. M., and Berry, W. E. (to Interchemical Corp.). **Wood-finishing system.** *U.S. Patent* No. 2,381,944, Aug. 21, 1945. Chem. Abstr. 40, 1946 (1050). P.R.

A hard, tough, smooth surface, free of blistering or bubbling, can be given to wood by coating the wood with a heat-polymerizable resin, as a mixture of a urea-HCHO and an alkyd resin, and then baking at 150–250° F. in an atmosphere of relatively high humidity.

[453]. 33.36 : 31.46. Browne, F. L., and Downs, L. E. **A survey of the properties of commercial water repellents and related products.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1493, 1945. pp. 21 + plates + tbl. P.R.

Data on tests of the properties of 55 commercial products to determine the character and range of effectiveness. Definitions of water-repellents, sealers and related products are listed in an appendix. In addition to the commercial products, phenolic-resin spar varnish complying with Army-Navy Aeronautical Specification AN-TT-V-118 applied in three full coats to form a film of substantial thickness over all surfaces of the test specimens, raw linseed oil, coal-tar creosote, raw tung oil and four formulas for diluted mixtures of linseed oil in accordance with Army, Corps of Engineers, Tentative Specification T-2288 of the American Army, were included to furnish a background for appraising water-repellency of the commercial products. Details of the test methods followed are given and results are tabulated and briefly reviewed.

33.36.1. *Preservation against Attack by Plants and Animals*

[454]. 33.36.1. **Report of special committee on co-ordination and standardization of treatment specifications.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (112–9).

Revision of a paragraph in the standard skeleton of the *Amer. Wood-Pres. Ass.*, which deals with final steaming. The skeleton treatment specification in its up-to-date form is set out in full.

[455]. 33.36.1. ANGELL, H. W. **Getting the most from treated lumber: a summary of the factors that affect treatability and the performance in service of pressure-impregnated wood.** *W. Cst. Lumberm.* 72 (10), 1945 (80, 82, 85–6). [American Lumber and Treating Company.]

A short review of the factors that affect treatability and the performance in service of pressure-impregnated wood. The principal kinds of preservative, and some of the major problems to be encountered in treatment, are described. The preparation of wood before treatment, e.g. seasoning, pre-conditioning, peeling and pre-framing, and the handling after treatment are dealt with. Laminated members, plywood, etc. are affirmed to be easily treated, provided that the latest type of water-resisting phenolic and resorcinol glues have been used.

[456]. 33.36.1. BOLIDENS GRUVAKTIEBOLAG. **Full-cell impregnation of timber or articles thereof.** *Brit. Patent* No. 571,816, Feb. 6, 1943. Brit. Abstr. BI, 1946 (30). P.R.

The timber is charged into a pressure-tight vessel which is then completely filled with a liquid (I) (to expel air) which may be either plain water or the liquid afterwards used for impregnation. With the vessel closed, (I) is pumped out and, after a pause under the vacuum thus produced, the impregnant (II) is admitted and its pressure raised by working the same pump reversed. (II) is a preservative solution or emulsion, preferably containing As.

[457]. 33.36.1. SCHIKORR, G., SCHULZE, B., and JOLITZ, B. Über das Rosten von Eisen in getränktem Holz. [**Rusting of iron in impregnated wood.**] *Korros. u. Metallschutz* 19 (2), 1943 (33–8). [G.g.] L.S.

Blocks of wood were impregnated with various types of wood preservative and dried. Steel screws were inserted and the blocks were exposed to tests in a laboratory (at about 97 per cent. relative humidity), and out of doors. Screws in untreated wood showed some rusting at first and thereafter very little. Rusting in impregnated wood was in most cases much more severe. NH_4CNS, $Al_2(SiF_6)_3$, $CuSO_4$ and $HgCl_2$ had a greater corrosive effect than $ZnCl_2$, $ZnSiF_6$ and $C_6H_3OH(NO_2)_2$. In nearly all cases the corrosive effect decreased with the passage of time. In wood impregnated with dichromate, rusting was small but later increased, probably because of a reaction between the dichromate and the wood. Painted wood caused very much less rusting than impregnated wood. In outdoor tests (70–95 per cent. relative humidity) rusting was considerably less than in laboratory tests. In wide-ringed wood the iron was somewhat less quickly attacked than in narrow-ringed wood. Tables and graphs show detailed results of the tests.

[458]. 33.36.1 : 12.25. **Report of Committee 5–6—Intermountain Douglas Fir and Western Hemlock.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (46–9).

Changes and additions to present specifications under Standard Specifications 38b, 41b and 51a were recommended. Standard Specifications for the preservative treatment by pressure processes of sleepers and timber (38c), piles (41c) and poles (51b) of Pacific Coast Douglas Fir, Intermountain Douglas Fir and Western Hemlock are given in the report. An addition is made to Standard 2d, regarding the mixing of species in a parcel without identification.

[459]. 33.36.1 (73) : 33.31 : 33.36.2 : 09.4. HELPHENSTINE, R. **Quantity of wood treated and preservatives used in the United States in 1944.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (236–59 + map + tbls.).

[460]. 33.36.1 : 31.42.12. SHUMARD, R. S. (to Monsanto Chemical Co.). **Sap stain control.** *U.S. Patent* No. 2,385,764, Sept. 25, 1945. Chem. Abstr. 40, 1946 (194). P.R.

Growth of moulds and sap-staining fungi on green wood can be prevented by a mixture of sodium 8-quinolinolate and sodium pentachlorophenate.

[461]. 33.36.1 : 31.43 : 12.26–8 : 13.2. BRIMBLECOMBE, A. R., and COOK, G. L. **Investigation of the boric acid treatment of White Cheesewood (*Alstonia scholaris*).** *Aust. Timb. J.* 11 (7), 1945 (329, 331). [Queensland Forestry Department.]

Investigations undertaken by the Queensland Forestry Department for the protection of White Cheesewood (*Alstonia scholaris*) against damage by *Lyctus brunneus* show that boric acid immersion treatments have definite commercial possibilities. Immersion in a 2·5-per-cent. solution near boiling point for 6 hours gave more than the minimum lethal concentration of boric acid in green sapwood to the centre of 1½-in. stock. Similar treatments for 4 hours were shown to be satisfactory for 1¼-in. stock, and a 1·25-per-cent. solution for 6 hours was sufficient to treat ¾-in. stock. [Cf. *For. Abstr.* 8 (No. 306).]

[462]. 33.36.1 : 31.43 : 13.2 : 33.31. HUNT, G. M., and SNYDER, T. E. **An international termite exposure test—sixteenth progress report.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (189–204). [U.S. Forest Products Laboratory, Madison, Wis.]

[463]. 33.36.1 : 33. **Report of Committee 7–10—diversified uses of treated wood.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (82–91).

This report deals with some of the many uses of treated wood, such as for building construction and use in mines. It also gives service records of posts on various experimental stations in the United States.

[464]. 33.36.1 : 33.12. **Report of Committee 7–11—uses of treated wood for car lumber.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (92–5).

A brief account is given of the use of treated timber in the manufacture of railway rolling stock and a report of service records of treated car lumber as compared with untreated lumber is appended.

[465]. 33.36.1 : 33.15 : 33.36.2. **Report of special committee on preservative and fire-retardant treatments of laminated members (plywood and glue up fabrication).** With appendices. *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (96–111).

Samples of Douglas Fir, Gum, Poplar and Birch plywood were made up in thicknesses of ¼-in. and ⁵⁄₁₆-in. three-ply, and ½-in. five-ply, using three types of glue, namely, phenol-formaldehyde resin, urea-formaldehyde resin, and fortified casein, according to standard gluing practice. These pieces were then treated by vacuum and pressure full-cell processes with one of two types of fire-retarding solutions. One type of treatment used a fireproofing compound consisting of a mixture of ammonium salts and boron compounds, and the other type used ammonium and boron compounds with the addition of a standard wood preservative. After treatment, the material was kiln dried, using a mild schedule.

Careful examination of specimens treated with ammonium and boron compounds alone indicates that the phenolic resin glue stood up to treatment very well and showed no visible signs of delamination or other failure. The fortified casein also gave good results, but the urea resin glue showed some delamination and failure. Specimens treated with ammonium and boron compounds plus standard wood preservative showed similar results, but the percentage of failure in urea resins was high. It is recommended that urea resin glues should not be used in plywood which will receive a fire-retardant treatment.

Results of gluing tests on pressure-treated wood are summarized. Casein and urea resin glues should not be used for outdoor exposure in humid climates or for salt-water marine applications. Phenol or resorcinol resin glues were durable under all conditions of exposure.

It has generally been considered impossible to glue creosoted wood satisfactorily, but during experiments conducted by one of the companies represented on this committee it was discovered that commercial cold-setting urea-formaldehyde resin adhesives would produce bonds of satisfactory shear strength if the treated wood was first smoothly surfaced on the faces to be bonded. Since urea-formaldehyde resins as a class are not considered durable under direct exposure to weather, further experiments are being made with cold-setting resorcinol - formaldehyde adhesives. Preliminary results have been highly satisfactory in respect of initial shear strength and wood failure of surfaced, creosoted test specimens subjected to standard shear tests.

Tests were made at the University of Washington on 18 glued laminated stringers, with the following results. Glued laminated beams, in general, are as strong as, or stronger than sawed beams, creosoted or untreated. Creosoting had no apparent effect on the glue used in these tests (phenolic resin). There was little difference in strength between beams which were untreated, creosoted, or incised and creosoted. Shear strength seems to be about the same in laminated beams incised or unincised, treated or untreated, and to be 25 per cent. or more greater than in sawed beams. Glued laminated beams are stiffer than sawed beams. Further study and more tests are required.

[466]. 33.36.1 : 33.31. **Report of Committee 4—preservatives.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (20–5).

The committee recommended the deletion from the *Manual of Amer. Wood-Pres. Ass.* of Standard 6b, which covers the float test, and of standard 21a, which contains unreliable tables on the specific gravities of zinc-chloride solutions. Tables giving comparison of trestles treated by low- and high-residue creosote and a tentative Standard Specification for creosote-petroleum solution are given.

[467]. 33.36.1 : 33.31. SWANSON, E. V. **Wood preservative.** *U.S. Patent* No. 2,370,378, Feb. 27, 1945. Chem. Abstr. 40, 1946 (696). P.R.

Rosin dissolved in turpentine is treated with Cl which has passed through a corrosive solution, such as Na_2O_2.

[468]. 33.36.1 : 33.31. HARTLEY, C. **Protecting green lumber against decay.** *Timberman* 47 (4), 1945–46 (108).

The risk of fungus damage to green timber, either in transit or soon after use, can be greatly decreased by dipping in a toxic solution at the sawmill. Solutions that have been successful in retarding decay in tests by the U.S. Dept. of Agriculture Division of Forest Pathology include the following:—

Chemical	*Lb. in 100 gals. water*
Lignasan (contains ethyl mercuric phosphate)	2
Dowicide H (sodium tetrachlorophenate)	7
Santobrite or Dowicide G (sodium pentachlorophenate)	7
Permatox 10S	10
A mixture made of—	
Santobrite or Dowicide G . .	3
Powdered borax	12
A mixture made of—	
Santobrite or Dowicide G . .	2
Lignasan	¾
Powdered borax	8

Treating is generally done at the larger mills and concentration yards by passing the conveyor chain through a dipping vat, and involves little additional labour. Spraying is effective if all surfaces are thoroughly wetted. At small mills where dipping is done by hand, the services of at least one additional man are usually required. The cost of chemicals is about 1 cent per gal. of solution at usual strengths, or about 15 cents per 1,000 bd. ft. of timber. For the best results, treatment should be given within 24 hours after sawing.

[469]. 33.36.1 : 33.31. BERRY, A. G. V., and CATER, J. C. **Interim report on trials of copper naphthenates and mercuric naphthenates as wood preservatives.** *Emp. For. J.* 24 (2), 1945 (233–5). [Trinidad Leaseholds Limited.]

In a previous paper [see *For. Abstr.* 3 (323)], the authors described the method of treatment and testing adopted in evaluating the wood-preserving properties of the naphthenates of copper and mercury in Trinidad. These metallo-organic salts were dissolved in gas oil and applied as solutions to specimens of wood by the open-tank process. The results from the commencement of the graveyard tests in June 1939 to the end of February 1941 were recorded. The present report deals with the 6 years to the middle of June, 1945. White Pine (*Pinus strobus*) was effectively protected against termites and fungi for about 6 years by the naphthenates of copper and mercury.

Twenty specimens of the perishable Laylay (*Cordia lockhartii*) treated with copper naphthenates in 15-per-cent. solution, completely resisted attack for 2½ years, but in the following few months 75 per cent. were destroyed by fungus. It is believed that a more even penetration of the preservative would have rendered this susceptible wood as completely immune to attack from fungus as it apparently was to termites.

Of 10 pieces of White Pine impregnated with gas oil alone, all were sound in 1944 and 6 were perfectly sound and 2 had been slightly attacked by termites but subsequently abandoned, when examined on 13th June, 1945.

The unexpected results obtained with gas oil alone have confused the tests of the metallic naphthenates and a new series must be started. As there is a considerable variation in the composition and properties of various types of gas oil, a further series of trials is now in progress, to evaluate its preservative properties.

[470]. 33.36.1 : 33.31. HÄGER, B. (to Bolidens Gruvaktiebolag). **Wood preservative.** *U.S. Patent* No. 2,384,026, Sept. 4, 1945. Chem. Abstr. 40, 1946 (194). P.R.

A wood preservative of good mycocidal and insecticidal properties consists of $FeSO_4 \cdot 7H_2O$, $H_3AsO_4 \cdot \frac{1}{2}H_2O$, H_2SO_4, and KBr which catalyses the oxidation of the ferrous iron.

[471]. 33.36.1 : 33.31 : 31.42.1. Jacquiot, C. Contrôle de l'efficacité des fongicides utilisés pour l'impregnation des bois: Étude critique de la technique standard anglaise et de la norme allemande DIN DVM 2176: Principes pour l'établissement d'une norme française. **[Control of the efficacity of fungicides used for the impregnation of wood: Critical study of the English standard technique and the German standard DIN DVM 2176: Principles for the establishment of a French standard.]** *Ann. Éc. Eaux For. Nancy* 8 (2), 1942 (185–206). [F.] [Laboratoire Central d'Essais des Bois, Paris.]

English and German standard tests of fungicidal wood preservatives are discussed and tentative proposals made for a French standard. Notes are given on the result of tests made at the Laboratoire Central d'Essais des Bois on various substitutes for creosote in the preservative treatment of railway sleepers. It was found that the nitro-phenols, though much inferior to creosote, gave some protection, and might be used during the war-time shortage. They might be expected to give protection for 3 or 4 years, but are only half as effective against *Coriolus versicolor* as against *Lentinus degener.* Both pyroligneous liquors, realgar and other arsenical compounds were either completely ineffective or had an antiseptic power so weak as not to be worth the expense of impregnation.

[472]. 33.36.1 : 33.31 : 33.52 : 12.26–8 : 31.42.11. Schmitz, H., Schrenk, H. von, and Kammerer, A. L. **Studies of the biological environment in treated wood in relation to service life. III. Changes in the character and amount of 60/40 creosote-coal tar solution and coal tar and the decay resistance of the wood of Red Oak crossties after five years' service.** With comment by L. B. Shipley. *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (153–88 + tbl.)

The second of a planned series of studies of the biological environment in treated wood in relation to the service life of Red Oak sleepers has been completed. The first study was based on 8 sleepers analysed after 3 years' service [see *For. Abstr.* 7 (No. 860)]. The present study was based on four sleepers after 5 years' service; two had been treated with a solution of creosote and coal-tar and two with coal-tar alone. After 5 years', and also after 3 years' service, the greatest changes in the chemical and physical characteristics of both preservatives occurred in the outer zones, with progressively smaller changes from the outer to the inner zones; changes in the bottom outer zone were somewhat greater than those in the top outer zone. The rate of change decreased somewhat in the last two years. At the end of 5 years' service there seems to be no significant difference between the toxicity of 60/40 creosote/coal-tar solution and coal-tar with respect to the concentration required to kill or inhibit Madison 517 or *Trametes serialis.* Thus all significant differences in the initial toxicity of these preservatives disappeared after 5 years. The concentrations of preservative extracted from these sleepers after 5 years' service required to kill *Trametes serialis* or Madison 517 are unexpectedly high. Experience, as well as the decay resistance of the test blocks, supports the contention that the sleepers treated with 60/40 creosote/coal-tar solution and with coal-tar will give many more years of service. The widespread concept of the importance of minor and even major differences in initial toxicity of coal-tar products seems to be untenable and must be modified to fit the facts.

[473]. 33.36.1 : 33.52. **African railways wartime enterprise: wooden sleepers pass test.** *Timb. and Plyw.* 90, 1946 (228, 230). P.R.

In Nigeria during the war, owing to difficulties in the production and transport of steel railway sleepers, a new wood-preservative plant was established at Zungeru in 1945. Special adzing and boring machines were installed to turn out an average of 750 sleepers per day. Two hundred and fifty sleepers at a time were impregnated with hot creosote under pressure. The plant has an area of a quarter of a mile by one hundred yards, a capacity reception of 72,000 sleepers and a capacity despatch of 50,000 sleepers. The comparative costs are 12*s.* for local treated wooden sleepers and 17*s.* for imported steel sleepers. One hundred and sixty miles of the Nigerian Railways are being re-layed with treated wooden sleepers.

[474]. 33.36.1 : 33.52. **Report of Committee 7–1—tie service records.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (57–65).

Tabulated tie service records of the University Avenue, Fair Grounds and Hartford test tracks in the U.S.A. Summaries of the results of inspections of the Northern Pacific Tamarack test track between Rice, Minn., and Gregory, also the Hemlock test track near Missoula, Mont., are given.

[475]. 33.36.1 : 33.52 : 12.25. **Report of Committee 5–2—Southern Pine ties and lumber, pressure treatment.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (29–31).

Various changes in the Tentative Standard Specification (53b) for preservative treatment of Southern Pine ties and lumber by pressure processes, which will be effective for another year.

[476]. 33.36.1 : 33.52 : 12.26–8. Bornebusch, C. H. Forsøg med billig Imprægnering af Bøgesveller. **[A trial with cheap impregnation of Beech railway sleepers.]** *Dansk Skovforen. Tidsskr.* 29 (11), 1944 (488–91). [Dan.]

Service data are given for Beech sleepers, laid in track in autumn, 1934, (*a*) treated with Cuprinol, Lacrysol, Carbomal or Solignum by dipping for a short period [penetration data tabulated; length and temperature not indicated]; (*b*) given a standard vacuum and pressure treatment with creosote; (*c*) untreated. Results to 1944 showed that though durability was improved by the treatments under (*a*), none of these was adequate for the exacting conditions to which sleepers are subjected. There was no consistent difference in preservative value between the various proprietaries used. The standard creosote-treated sleepers all remain in track.

[477]. 33.36.1 : 33.52 : 12.26–8. **Report of Committee 5–1—Oak ties and lumber, pressure treatment.** With written discussion. *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (25–9).

Amendments to Tentative Standard 52a for the treatment of Oak ties and lumber by pressure processes.

[478]. 33.36.1 : 33.52 : 12.26–8. **Report of Committee 5–3—Gum ties and lumber, pressure treatment.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (31–2).

It is necessary to make a distinction between heartwood and sapwood in determining the penetration of preservative in sleepers and timber of Red Gum, but not of Black Gum. Different penetration requirements for Red and Black Gum are therefore necessary, but where net retention is concerned, no distinction need be made. Charges containing both types of timber must not be accepted for penetration based on Black Gum penetrance bore cores alone.

[479]. 33.36.1 : 33.53. **Report of Committee 7–7—pole service records.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (74–81).

[480]. 33.36.1 : 33.53. **Report of Committee 5–5–1—poles, pressure treatment.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (33–8).

The report deals with recommended changes to be made in Tentative Standard Specification 57a and proposes that the suggested amended Specification should be used as a Tentative Standard for another year.

[481]. 33.36.1 : 33.53. **Report of Committee 5–5–2—poles, non-pressure treatment.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (39–46).

This report deals with the Osmoplastic and sodium fluoride creosote treatments, and the charring and spraying methods. Results of service of Chestnut and Cedar poles are given.

[482]. 33.36.1 : 33.53. **Report of Committee 7–4–1—marine pile service records.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (70–4).

[483]. 33.36.1 : 33.53. Seyer, W. F. **The leaching of copper, zinc and arsenic salts from wood piles.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (137–44).

The rate of leaching of toxic solutions from round Douglas Fir piles has been measured and it was found that, after one year, about 45 per cent. of the salts had been removed. Analyses of solutions, fresh-water leaching after 36 days' leaching, total or integrated loss in fresh-water leaching, and the amount of preservative in blocks after a definite time, are tabulated. A curve is drawn on double log graph paper to show how much salt must be introduced originally so that a definite amount will remain in the pile after a certain lapse of leaching time.

[484]. 33.36.1 : 33.53–4. Connecticut. **Connecticut Agricultural Experiment Station: report of the Director for the year**

ending October 31, 1944. *Bull. Conn. agric. Exp. Sta.* No. 484, 1945 (55–103).

In 1933, eleven poles each of Red Maple, Red Pine, Scotch Pine and Pitch Pine were set up. Seven poles of each species had been treated with creosote for a distance of 3 ft. from the butt. The remaining 4 poles of each species were left untreated. In addition to the above, there were 24 squared hardwood poles which had been given zinc-meta-arsenite treatment under pressure. Inspections were made in 1934, 1940, 1944, with the following results:—

Z.M.A. treated hardwoods	*Untreated Maple and Pine*	*Butt-treated Maple and Pine*
1934. Good condition throughout.	Decay at ground line.	Good condition throughout.
1940. Good condition throughout.	Unserviceable because of decay at ground line.	Three Pine showed signs of failure at top; condition otherwise good.
1944. Good condition throughout.	—	Creosoted part of all poles still sound and in excellent condition. Tops of Maple poles still serviceable but those of Pine all in poor condition.

Two conclusions are drawn from these experiments. (*a*) A thorough butt treatment with creosote by the open-tank process may be expected to protect posts of Pitch, Red and Scotch Pine against decay when in contact with the soil, for a period of 15 years or more. (*b*) The untreated tops of poles of these species may become unserviceable in five years and probably cannot be expected to last more than 12 years in most cases. Treatment of the top is needed to insure a proper balance of durability between the top and butt (pp. 78–9).

[485]. 33.36.1 : 33.54. **Report of Committee 7–9—post service records.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (82 + tbls.).

[486]. 33.36.1 : 33.54. **The preservative treatment of fence posts and farm timbers.** *Reg. Bull. U.S. Dep. Agric. Soil Conserv. Serv.* (*S.W. Reg.*) (*Reg.* 6), No. 95 (*For. Ser.* No. 15) (revised), 1945. pp. 31. P.R.

Directions for the treatment of fence posts and farm timbers with creosote and zinc chloride by the osmose and cold-soaking methods with quantities and costs, and comparative efficiency. A descriptive list of very durable woods with data on durability and the service life of Juniper posts are given. Control measures for subterranean termites in the south-west United States are summarized.

[487]. 33.36.1 : 33.54. **Selecting a suitable method for treating fence posts.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1468, 1946. pp. 6.

A discussion and estimation of the relative cost and effectiveness of the best-known preservative treatments for fence posts, including commercial pressure treatment, hot-and-cold-bath treatment with creosote, the pentachlorphenol cold-soaking method and various water-borne preservative treatments.

[488]. 33.36.1 : 33.54. **Preservation of timber by the steeping process.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*621, 1945. pp. 10 + tbls. P.R.

General data on preservatives, preparation of wood for treatment by this process, treatment, control of strength of solution, cost and effectiveness of treatment. A table of treatment and service data for posts thus treated is appended. In all cases it is shown that treatment considerably lengthened the life of the posts.

[489]. 33.36.1 : 38.3. **Report of Committee 7–2—bridge and structural timber.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (66–70).

A report on a railway bridge which had been in service for 42 years. Sixty per cent. of the old creosoted stringers were found to be to some extent ‘soft’; the bonds between the growth layers having been weakened by severe treating conditions.

[490]. 33.36.1 : 52.43.2 : 33.53. **Report of Committee 5–9—inspection.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (49–57).

Amendments to Tentative Standard 33c of Standard Instructions for the Inspection of Preservative Treatment of Wood were recommended. Methods of measuring cubic volumes of round forest products, as given in Standard 14b, were stated to be frequently incorrect and a Tentative Standard (14c), based on a single measurement at mid-point was proposed. Methods, with tables and formulae are given in full. The original method, described in 14b, is retained as an alternative method, for use where the mid-point method is not practicable, and correction factors, tables and the formula are also given.

Changes are made in Standard 2d, to comply with a request by the Preservatives Committee for the inclusion of chromated zinc chloride, Tanalith and zinc meta-arsenite.

33.36.2. *Fireproofing*

[491]. 33.36.2. Putman, R. B. **Flameproofed lumber.** *Sth. Lumberm.* 171 (2153), 1945 (111–3).

A brief review of the recent increased utilization of fireproofed wood for a variety of purposes, with particular reference to 'Minalith' flameproofing compound.

[492]. 33.36.2. **Fire-resistant treatment of wood.** *Chemurg. Dig.* 4 (20), 1945 (327–31). [Protexol Corporation, Kenilworth, N.J.] P.R.

A general survey of the fire-retardant treatment of wood. Impregnation methods are briefly described. The author emphasizes the necessity for evolving methods of testing which will result in a material as nearly uniform as possible. A list of test methods is given with some average results obtained from Class A material. The effect of treatment on other properties of the wood is discussed, and a brief account is given of the combination of fire-retardant with preservative treatment. Chemicals used in Protexol processes are described and the article ends with a discussion of the treatment of plywoods.

[493]. 33.36.2. Kleeck, A. van. **Fire-retarding coatings.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1280 (revised), 1946. pp. 11. P.R.

A report on a series of tests with fire-retarding coatings undertaken at the United States Forest Products Laboratory, Madison. Tests used, among others, were the fire-tube test and a modification of the Schlyter test. Formulae and methods of making are given for borax linseed-oil paint, and water solutions of sodium silicate and ammonium phosphate and other fire-retarding chemicals. Methods and formulae are given for a new type of coating developed at Madison and found to be very effective, consisting of finely ground fire-retardant chemical dissolved and suspended in an aqueous sodium or ammonium alginate gel. Methyl cellulose preparations, whitewash, casein paints, magnesium oxychloride and magnesium oxysulphate coatings and synthetic-resin formulations are discussed. Water-insoluble preparations such as zinc borate, chlorinated rubber and chlorinated paraffin have the advantage over water-soluble fire-retardants in their ability to retain their effectiveness after exposure to water, but their effectiveness as fire-retardants is very much less.

[494]. 33.36.2. Hall, H. W. **Fireproofing, waterproofing, densening and hardening of wood surfaces.** *U.S. Patent* No. 2,366,025, Dec. 26, 1944. Chem. Abstr. 40, 1946 (442). P.R.

A mixture of powdered or fine-fibre asbestos, a urea-CH_2O adhesive and a curing catalyst for the latter, is applied on the surface of a wood panel. A small quantity of dry pulverized asbestos is then sprinkled on and the panel is placed in a press and lightly pressed to smooth the applied material. The plates are heated to approximately 250° F. or until the mass becomes plastic and then the pressure is raised to 100–200 lb. per sq. in. After sufficient time is allowed for curing (5–30 minutes) the product is cooled and removed from the press. For certain kinds of products it may be desirable to impregnate the wood, e.g. *in vacuo*, with an aqueous solution of urea-CH_2O prior to applying the asbestos-adhesive mixture. In the urea-CH_2O solution used for preliminary impregnation of the wood, the condensing catalyst is omitted. Also if an aqueous solution is used for impregnation, the H_2O is driven off before the asbestos mixture is applied.

[495]. 33.36.2. Jones, G., and Juda, W. (to Albi Chemical Corp.). **Fire-retarding impregnating composition for wood.** *U.S. Patent* 2,386,471, Oct. 9, 1945. Chem Abstr. 40. No. 1946 (194). P.R.

A fireproofing composition is prepared from mono- or di-ammonium phosphate, copper sulphate, ammonia and sodium dihexyl sulphosuccinate.

[496]. 33.36.2. **Report of twenty-minute fire test made upon a ceiling panel surface-treated with Albi-'R'.** *Rep. Dep. civ. Engng. Columbia Univ.* No. 2562, 1945. pp. 6. P.R.

[497]. 33.36.2 : 33.15.1. HARTMAN, F. A. **Fire retardant plywood.** *Protexol News* No. 11. pp. [4]. [Protexol Corporation, Kenilworth, N.J.] P.R.

A general survey of fire-retardant plywoods, their increased efficiency, uses and reactions to fire attack. An account of chemical impregnants is given, with a discussion on treatment before and after bonding.

[498]. 33.36.2 : 33.36.1 : 33.31. SCHEFFER, T. C., and KLEECK, A. VAN. **The decay resistance of wood impregnated with fire-retarding ammonium salts.** With written discussion. *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (204–11). [U.S. Bureau of Plant Industry.]

Laboratory tests on Pine sapwood treated with ammonium salts showed high initial resistance to decay. Continued and very high relative humidities imposed by test methods caused considerable leaching but the resultant decay resistance remained high and was never less than that of corresponding untreated wood. It seems probable, therefore, that the tested ammonium salts in ordinary commercial absorptions did not constitute a decay hazard but provided substantial protection to wood to be used off the ground. Tests were also carried out on wood treated with combinations of ammonium salts and water-soluble wood preservatives, but there was no evidence that the inclusion of these salts reduced the toxicity of the fungicides. [Cf. *For. Abstr.* 8 (No. 465).]

33.36.3. *Seasoning. Drying*

[499]. 33.36.3. DESCH, H. E. **Chemical seasoning.** *Timber News* 54 (2081), 1946 (92–4).

Chemical seasoning methods are based on the principle that aqueous solutions of certain chemical substances have lower vapour pressures than pure water. If, before kiln seasoning, the outer layers of the timber are treated with certain salt solutions, the vapour pressure of the moisture in these layers falls below that of the surrounding atmosphere. Thus, the equilibrium moisture content of the outer layers can be kept above fibre saturation point, and immediate drying and the consequent case-hardening and checking can be avoided. Consignments of treated wood can be dried in relative humidities which cause untreated wood to check, e.g. Douglas Fir 6 × 6 in. and upwards can be safely dried with relative humidities of 75 per cent., whereas, untreated, it will check when dried by relative humidities as high as 90 per cent. By selecting a suitable schedule for a kiln run, chemically treated wood can be dried almost to the final stage before the outer layers are dried below fibre saturation point.

Urea and sodium chloride are the most suitable salts, but the latter is liable to have a corrosive effect and to cause the timber to sweat subsequently. Urea has been employed on a considerable scale with satisfactory results. The economic practicability of the process for small timbers is still open to question, but it is undoubtedly the best method of seasoning really large timbers.

[500]. 33.36.3. RASMUSSEN, E. F. **A method of seasoning small quantities of lumber.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1608, 1946. pp. 7 + figs.

The problems of seasoning timber in small quantities are reviewed. A combination of outdoor air seasoning with further drying in a heated room is recommended for wood to be employed for furniture, etc. The report instructs the woodworker how to pile timber for outdoor and indoor drying, how to control the drying rate and prevent checking and how to determine the moisture content of timber.

[501]. 33.36.3. IRSA, G. I. DE (to Wood Impregnation Ltd.). **Drying of wood.** *Brit. Patent* No. 572,708, June 15, 1943. Brit. Abstr. B.I., 1946 (67). P.R.

The wood is immersed in hot H_2O in a closed chamber and the H_2O is removed under vacuum (20 in. Hg). The chamber is then heated and the vacuum increased to 28–29 in. CO_2 may be used in the vessel to prevent re-absorption of H_2O, and CaO may also be added to neutralize any acids set free during drying. Apparatus is described and claimed.

[502]. 33.36.3. Déribéré, M. Le séchage du bois par rayonnement infrarouge. **[Wood seasoning by infra-red rays.]** *Rev. int. Bois.* 9 (94), 1942 (121–6). [F.] Déribéré, M. Applications du séchage par rayonnement infrarouge au séchage du bois. **[Applications of drying by infra-red rays to the seasoning of wood.]** *Rev. int. Bois.* 13 (104), 1946 (27–30). [F.]

The first of these articles describes how the process of drying by infra-red rays could be applied to wood, with particular reference to wood intended for veneer cutting. The second article deals with several particular or new points; e.g. temperatures, mode of action of infra-red rays, vibratory mechanism. The following table gives results obtained on planks of different species under Mazda IR 250W lamps placed 25 mm. apart and 25 mm. above the wood.

	Poplar		*Oak*	*Beech*
Thickness in mm.	25	20	20	25
Moisture content (per cent.)	33	45	35	27
Time for removing:				
10 per cent. of moisture	1 hr. 10 m.	2 hr.	3 hr.	1 hr.
20 per cent. of moisture	3 hr. 10 m.	4 hr. 30 m.	6 hr.	2 hr. 10 m.
Energy in kwh/kg. for removing:				
10 per cent. moisture	0·36	0·53	0·7	0·2
20 per cent. moisture	0·92	1·18	1·4	0·42

Satisfactory results have also been obtained in drying sawdust and wood flour on conveyor belts. [Cf. *For. Abstr.* 7 (No. 340).]

[503]. 33.36.3. **Timber drying kilns and conditioning chambers.** G. F. Wells, Ltd., Drying Kiln Specialists, Sheffield. pp. 20.

[504]. 33.36.3 (82). Melillo, A. C. La acción del estado y el cooperativismo en la industria del secado de la madera. **[State action and co-operation in the wood-seasoning industry.]** *Maderil* 18 (2), 1945 (9–10).

Emphasis is laid on the need for efficient kiln-drying installations in Argentina in order that the Argentine timber industry may compete successfully with that of other countries. At the present time timber industrialists are not fully aware of the importance of artificial drying of wood and of the technical skill required in the process, with the result that native timbers tend to be discredited owing to lack of proper seasoning.

The author suggests two solutions to the problem: (1) the setting up of large kiln-drying installations in the most important centres, run either entirely by the State or by corporations financed by private capital; or (2) the formation of co-operatives to take over the kiln-drying of timber in particular zones. Alternatively, kiln-drying installations could be set up by the State and transferred to co-operatives as soon as the advantages of artificial drying of timber previous to sale had been demonstrated.

[505]. 33.36.3 : 07.7 : 33.7 : 33.38.2. Tørreanlæg til Generatorbrænde. **[Drying plant for gas-generator fuel.]** *Dansk Skovforen. Tidsskr.* 26 (7), 1941 (259–62). [Dan.]

[506]. 33.36.3 : 07.7. Carter, R. M. **Principles of design that affect the operation of a natural circulation kiln.** *For. Prod. Pap. Ntheast. For. Exp. Sta.* No. 3, 1946. pp. 10.

The function of heat, relative-humidity control and air circulation in a natural-circulation kiln is discussed. A suggested arrangement of heating coils to produce the required circulation of air is described and illustrated, and suggestions are made for steam sprays and ventilator controls.

[507]. 33.36.3 : 07.7. Carter, R. M. **Piling and its effect on drying in natural circulation kilns.** *For. Prod. Pap. Ntheast. For. Exp. Sta.* No. 2, 1946. pp. 10.

The paper describes and illustrates the wrong and right methods of piling timber in a natural-circulation kiln, so that a good air circulation is obtained and rapid and uniform drying takes place.

[508]. 33.36.3 : 31.22.1. SMITH, H. H. **Use of kiln samples in operating a lumber dry kiln.** *Rep. U.S .For. Prod. Lab., Madison* No. *R*1607, 1946. pp. 6 + figs. P.R.

Kiln-drying schedules for seasoning are evolved from the use of kiln samples by which the moisture content of the stock can be measured. For general hardwood kiln drying, however, the development of a time/temperature schedule is less satisfactory than the use of a full number of kiln samples with each load. The procedure for the selection, preparation and use of kiln samples is detailed, with the formulae for determining moisture contents and oven-dry weights of samples. Methods of cutting for stress and moisture distribution tests are also described and illustrated.

[509]. 33.36.3 : 33.13. WAGNER, J. B. **Air drying or seasoning of staves.** *Barrel & Box* 50 (9), 1945 (13–4). P.R.

Slow methods of drying are recommended for cooperage wood. Ways of piling barrel staves for air seasoning are described.

[510]. 33.36.3 : 33.92. PECK, E. C. **Seasoning, storage, and handling of ship planking and decking: suggestions to ship and boatbuilders.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1606, 1945. pp. 5 + tbl. + figs. P.R.

The recommended average moisture content for planking and decking is 15 per cent. with a minimum of 12 and a maximum of 18 per cent. Tests for the moisture content of planking and decking and methods of seasoning, if further drying is required, are described. Recommendations as to the handling and storage of timber are also made. A table gives temperatures and relative humidites which cause wood to reach a moisture content of 15 per cent. Ways of piling are illustrated by figures.

[511]. 33.36.3 : 38.2. TEESDALE, L. V. **Reducing hazards of green framing lumber in post-war housing.** *Sth. Lumberm.* 172 (2156), 1946 (45–7). [U.S. Forest Products Laboratory, Madison, Wis.]

A review of the inconveniences attendant on the use of unseasoned timber in building (particularly houses) and of practices recommended to minimize the ill effects. By heating the inside of the building to 20° F. or more above the outside temperature at any time of the year, the rate of drying is materially increased; therefore the heating plant should be installed at the earliest possible moment, and before floors, skirting boards, etc. are set up, and the heating kept on while work progresses.

33.37. Distillation. Manufacture of Tar

[512]. 33.37 (43.1–5). GREAVES, C. **Wood distillation plant at Brilon-Wald.** *Final Rep. Brit. Intell. Obj. Sub-comm.* Item 22, No. 128, 1945. pp. 7. P.R.

The plant was visited on the 6th and 7th November 1945. It is owned by the Degussa Co. [cf. *For. Abstr.* 8 (No. 515)], and is the main producer of wood distillation products in Germany. At present it is only working to 40 per cent. of full pre-war capacity. The present capacity of the plant is 4,000 solid cu.m. of wood per month. At least 99 per cent. of the wood carbonized is Beech obtained from districts surrounding the plant within a radius of 100 km. The process employed is the Reichert method. Alcohol, acetic acid, charcoal briquettes and activated charcoal are also made at this plant.

[513]. 33.37 : 33.38.2 : 34.6. EL'KIN, D. I. K voprosu ekonomiki forpiroliznoy peredvizhnoy ustanovki. **[On the question of the economics of a mobile plant for partial pyrolysis.]** *Lesnaya Prom.* No. 1/2, 1945 (8–10). [Russ.]

A. K. Slavyanski's method of partial pyrolysis of wood, in mobile retorts that could be used on the actual felling site, is believed to be of great importance as a means of utilizing the vast quantities of logging waste in the U.S.S.R., where it is estimated that at least 100 million cu.m. of waste is annually left on felling sites, costing tens of millions of roubles to collect and burn. The procedure is: Wood is placed in the retort, kerosene is poured over, and heat is applied. The kerosene and water vapour are driven off, cooled, and the condensate separated in a 'florentine'. The water is led through lime for neutralization and the kerosene collected in a container. As the temperature is increased, the acidity of the vapour also increases; at first the liquor from the vapour is caught in a special vessel, later a strong liquor of 25–30 per cent. acidity comes over and is further treated in a still to obtain 'black acid' and resins. After the 'black liquor' has been driven off, steam is passed into the retort to remove kerosene from the latter and from the wood. The special feature of the process is the use of kerosene as a means of transmitting heat, thus enabling the process to be completed in 8 hours instead of the 23–36 hours required with ordinary dry distillation: moreover, the actual pyrolysis, including drying of the wood, takes only 4 hours. The possibility of obtaining a liquor with an acidity 3–4 times that normal in ordinary distillation allows a considerable reduction in the overall dimensions of the apparatus for the further treatment of the liquor, a fact of particular importance to the development of a mobile or portable plant. Whereas temperatures in ordinary distillation are about 400° C., the new method works at 280°. The consequent milder conditions of pyrolysis prevent secondary reactions in the products, thus increasing the yield of acetic acid, and the incomplete carbonization gives, instead of charcoal, 'brown wood' which is non-hygroscopic, has a calorific value up to 6,000 cal. per kg. and should be 1½ times as cheap as ordinary producer-gas wood, which has a calorific value per kg. of about 3,000 cal. There is no need for a very large drying plant as in the preparation of ordinary producer-gas wood. The 'brown wood' is also a possible raw material for pencil manufacture instead of Siberian Pine.

The remainder of the paper is devoted to a consideration of the rôle of kerosene (as a heat carrier only) and kerosene losses during the process, expenditure of fuel and steam, the productive capacity of the apparatus (Slavyanski's mobile retort, of total capacity 8·24 cu.m., charge capacity 4·07 cu.m., time per charge 8 hours, is calculated to have a productive capacity of 0·062 cu.m. per hour per cu.m. total capacity), metal necessary in construction, costs and economic efficiency. The estimated requisites and yields per stacked cu.m. of wood are summarized in the following table:—

Requisites		*Yields*	
Fuelwood	0·78 stacked cu.m.	Black 60-per-cent. acetic acid	24·60 kg.
Kerosene	1·0–1·4 kg.	'Black powder 60 per cent.' (calcium acetate)	12·3 „
Lime	3·3 kg.	Resin	6·2 „
Water	0·25 cu.m.	'Brown wood'	206·5 „
Labour	5 roubles 20 cop.		
Amortization of equipment	3 roubles 20 cop.		

The annual capacity of the plant, based on 300 working days, is 3,660 stacked cu.m. of raw material. Economically the process appears to be amply justified.

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-gas Generators

[514]. 33.38. (410). Kenyon, L. G. T. **Charcoal production.** *Forestry* 19, 1945 (86–94). [Forestry Commission and Ministry of Supply.]

The writer was in charge of charcoal production in the Home Timber Production Department of the Ministry of Supply during the war, and this account of the process of charcoal production is based on the work of that department, which made use only of circular steel kilns of the portable type which greatly reduced the amount of transport needed. The equipment, lay-out, lighting and loading of the kilns is described and notes are given on the varying grades and uses of charcoal derived from different species of wood. One of the most recent uses of charcoal is as a filtering and storage agent in the process of penicillin production. For this purpose the charcoal is 'activated' by steam pressure, and tests so far carried out show that softwood charcoal is particularly suitable.

[515]. 33.38 (43.1–5). Gay, G. **Ernst Beuttler Werke, Dinglingen, near Lahr.** *Final Rep. Intell. Obj. Sub-comm.* Item 8, No. 425, 1945. pp. 5. P.R.

The object of this visit was to investigate the manufacture of active charcoal used in the German service respirator. Forty-five tons of charcoal were manufactured per month from base charcoal received pulverized from the Degussa Werke [see *For. Abstr.* 8 (No. 512)] who manufactured it from Beech wood. Details are given of the equipment and the process employed.

[516]. 33.38 : 12.26–8. Hanley, N. A., and Pearse, J. F. **The destructive distillation of four Western Australian Eucalypts.** *J. Proc. Aust. chem. Inst.* 12 (8), 1945 (263–72).

An investigation of the products of Jarrah (*Eucalyptus marginata*), Wandoo (*E. redunca*), Karri (*E. diversicolor*) and Marri (*E. calophylla*) was carried out to obtain information necessary for the establishment of a charcoal-iron industry in Western Australia, which is dependent on the availability of an abundant supply of charcoal at a cheap cost. The composition of the distillate and wood-gas at various temperatures and the relationship of volatile content of charcoal to the temperature of retorting were studied. Yields, based on the standard methods of analysis of wood distillation products, of acetic acid and methyl alcohol obtained from the four species are lower than those obtained from North American hardwoods. Marri gave the highest yields of both products whilst the lowest yields were obtained from Jarrah.

[517]. 33.38.1. Goos, A. W., and Reiter, A. A. **New products from wood carbonization.** *Industr. Engng. Chem.* (*Industr. Ed.*) 38 (2), 1946 (132–5). P.R.

Tars and oils are obtained as by-products of hardwood carbonization to the extent of about 12·2 per cent. of the wood carbonized. A practical general procedure for separating such mixtures into their most important individual compounds is described and specific examples are given. Lists of compounds which can be produced from by-product tars and oils are presented. *Authors' summary.*

[518]. 33.38.1 (72). Juárez Herrera, R. El carbón vegetal en la economía domestica como producto de la destilación seca de las maderas. **[Wood charcoal in [Mexican] domestic economy as a product of the dry distillation of wood.]** *Méx. for.* 23 (6/9), 1945 (55–7). [Span.]

Calorific values are given for the wood of some common coniferous and hardwood species. The composition and uses of wood charcoal and the methods employed in its manufacture are indicated.

[519]. 33.38.1 : 33.37 : 34.26. Gilardi Rodriguez, L. Subproductos de la explotación de bosques. **[By-products of forest utilization.]** *Agronomia, Lima* 10 (40), 1945 (39–59). [Span.] L.S.

Brief descriptions of wood charcoal manufacture, wood distillation, and the resin industry in Peru.

[520]. 33.38.2 (54). Sengupta, B., and Apte, V. V. **A mobile producer-gas plant using inferior grades of charcoal and wood-chips as fuel. Part I.** *J. sci. industr. Res., India* 4 (5), 1945 (301–9). [Department of Industries, Bombay.] I.H.

Description of a modified type of generator of the conventional down-draught type and of double-shell construction which has given satisfactory results with waste wood (Teak and jungle wood) and with inferior grades of charcoal both in the laboratory and in road tests. Wood fuel produced about 10 per cent. higher power than was produced with charcoal fuel, and 15·3 per cent. higher power than was obtained with the conventional down-draught plant using charcoal as fuel. The results indicate that wood can be successfully used as a fuel for mobile producer-gas plants in India.

33.39. Manufacture of Sugar and Alcohol from Wood

See also *For. Abstr.* 8 (Nos. 403, 408–9, 437).

[521]. 33.39. Hartmann, H. **Saccharification of wood or similar cellulosic materials.** *German Patent* No. 742,842, Oct. 21, 1943. Chem. Abstr. 40, 1946 (464). P.R.

Air-dry wood or other cellulosic material (containing 20–40 per cent. water) is saccharified by treatment with acid vapours. The heat of reaction is kept down by injecting a suitable organic solvent.

[522]. 33.39 (43.1–5). Campbell, W. G., and Bunker, H. J. **The saccharification of wood by the Bergius process at Süddeutschen Holzversucherung Werke** [*sic*—Süddeutsche Holzverzuckerungswerke] **A.G., Regensburg.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 7, Item No. 22 [1945?], pp. [10]. P.R.

A description is given of the Bergius process as used at the Süddeutsche Holzverzuckerungswerke for the production of wood sugar for food yeast. An additional report, compiled apparently by the factory itself, gives analyses of the yeast products.

[523]. 33.39 (43.1–5) : 34.6. Greaves, C. **Scholler wood sugar plant at Holzminden.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 176, Item No. 22 [1945?]. pp. 15 + tbl. P.R.

A description of the process used at Holzminden for converting wood (mainly sawdust and shavings of coniferous woods) to sugar. The wood is discharged into a percolator and treated with hot, dilute sulphuric acid. The sugars are drawn off in solution and are subjected to the action of growing yeast. The yeast growth can be so regulated that either alcohol or an increased quantity of yeast can be produced.

The report gives an account of the raw materials used and their sources, and a description of the apparatus and equipment used, with tabulated instructions for carrying out a percolation.

[524]. 33.39 : 34.6. Tousley, R. D. **Prospective post-war costs of producing alcohol.** *Pulp Pap. Mag. Can.* 47 (1), 1946 (48–55).

The five raw materials now constituting possible sources of ethyl alcohol, are ethylene, molasses, grain, waste sulphite liquor, and wood waste. The prospective costs of production of the processes utilizing these materials are discussed in some detail. The analyses are not designed to show total costs of production but are intended to indicate relative costs. The following costs of production are worked out: synthetic alcohol from ethylene, 13–14 cents per gal. (but 9–10 cents if the cost of pure ethylene were reduced to 2 cents per lb.); alcohol from molasses, about 16 cents per gal.; alcohol from grain, 20·3–23·5 cents per gal.; alcohol from waste sulphite liquor in the larger pulp mills of the Pacific Northwest, 15–19 cents per gal. (these figures are applicable only to plants that can produce about 5,000 gallons of alcohol daily, and only to the area indicated); alcohol from wood waste (total costs including depreciation) 20·5–22 cents per gallon.

It is concluded that molasses alcohol should be able to compete successfully with synthetic, provided that the price of molasses were sufficiently low. Grain and wood waste appear to be sources of alcohol of relatively high cost, which cannot compete successfully on a free market with synthetic and molasses alcohol. The development of profitable uses for by-products is the most hopeful method of reducing production costs. Conclusions with respect to peace-time, competitive possibilities of alcohol from sulphite waste liquor are less definite. The writer is of the opinion that only mills with a daily pulp production of not less than 200 tons can operate an alcohol plant economically, and his figures are based exclusively on conditions in the Pacific Northwest, where production costs are probably much lower than elsewhere in the United States.

[525]. 33.39 : 34.6. Harris, E. E. **Industrial alcohol from wood waste.** *Sth. Lumberm.* 171 (2153), 1945 (244–6, 248). [Forest Products Laboratory, U.S. Forest Service.]

A fairly detailed account of the modified Scholler process for acid hydrolysis of wood waste to sugar and then, by fermentation, to ethyl alcohol, which has been developed by the Forest Products Laboratories, Madison, and is to be operated at the great pilot plant being erected at Springfield, Ore. [cf. *For. Abstr.* 7 (Nos. 344, 883)]. Characteristics of the Madison process as compared with the Scholler process are the higher concentration of sugar (5 per cent. as compared with 3 to 4 per cent.) with the use of less acid (about 1·6 lb. per gal. of alcohol instead of 3 lb.), less water (8 parts instead of 14 parts), and less steam by about one-third. Yields of alcohol by the Madison process range from 54 to 68 gals. from softwoods and 35 to 48 gals. from hardwoods, per ton of dry bark-free wood. By-products from a ton (dry basis) of softwood mill waste such as Southern Yellow Pine consist of 600–750 lb. of lignin, 1½ gals. of furfural, 1½ gals. of methanol, and solutions containing about 160 lb. of non-fermentable sugars and about 30 lb. of volatile organic salts. By-products from hardwoods have a smaller proportion of lignin and more of the other substances.

It has been estimated that the price of alcohol in the Springfield plant, if hogged wood waste is available at $2 per ton (dry, bark-free basis), will be 20 to 22 cents per gallon, assuming a normal rate of amortization and upkeep. This price may be lowered by 7 to 9 cents per gal. by the sale of methanol, furfural, and yeast. If markets can be found for lignin, the price may be lowered still further. The cost of producing alcohol from molasses in the years 1928–38, when molasses was 7–8 cents per gal., was 31 to 34 cents per gal.

It appears that alcohol can be produced from wood at prices that will compete with other sources, provided that use is made of the by-products, and that wood waste is available in large enough quantities to make full use of the manpower required to run the plant, which is almost independent of plant size.

[526]. 33.39 : 34.6. HANES, C. S. **Treatment of cellulosic material with a view to production therefrom of glucose.** *Brit. Patent* No. 572,638, March 14, 1941. Brit. Abstr. B III, 1946 (22). P.R.

Cellulosic material, e.g. wood waste (after pre-treatment for removal of hemicelluloses and lignin if desired), is treated with a concentrated aqueous solution of an acid (e.g. H_2SO_4) in presence of an ester (I) of relatively low boiling point (e.g. EtOAc or C_5H_4O) and an organic acid (II) (e.g. AcOH) to produce cellodextrins (III) soluble in the acid mixture and in H_2O. (III) are then precipitated by further addition of (I) and separated after washing; they are then dissolved in H_2O to form a relatively concentrated solution in which glucose is produced by hydrolysis by heating with dilute acid at $\nless$ 100°. Dissolving and precipitating liquids or their components are separated and regenerated and distillation for recovery of (I) takes place in the presence of (II) to prevent hydrolysis.

[527]. 33.39 : 34.6. WHIPPLE, O. K. **The hydrolysis of wood waste.** With comment by R. S. Aries. *Rep. 5th Vermont Wood Prod. Conf.* 1945 (13–26). P.R.

Methods of hydrolysing wood waste for the production of sugars and ethyl alcohol are summarized, and the economic aspect reviewed. The treatment of hardwoods with steam under pressure for yields of furfural, acetic acid and methanol before the regular hydrolysis process is dealt with and a tabulated comparison of the yield and value of products obtained by wood saccharification and by carbonization are also given.

33.4. *Converted Structural Timber*

[528]. 33.4. ARMSTRONG, F. H. **Timber for floors.** *Off. Archit.* 9 (2), 1946 (82–4). P.R.

The article deals with the factors to be considered in the choice of wood for flooring, and some recommendations as to species are made. A description of the abrasion testing machine at Forest Products Research Laboratory, Princes Risborough, is also given.

[529]. 33.4 (97). ENGEL DE JANOSI, K. L. **Hardwoods for floorings.** *Timb. Tr. J.* 177 (3634), 1946 (243–4).

The use of softwoods for flooring was general in Great Britain before the war, but the writer urges that hardwoods are better for the purpose and, though they cost a little more, are so much more satisfactory and wear so much better that they are in fact more economical. Moreover, while most of these softwood floorings were imported from U.S.A., Canada and Sweden, excellent hardwoods are produced in the colonies, and use of these would save foreign currency. [Cf. *For. Abstr.* 8 (Nos. 364–5, 551).]

[530]. 33.4 (73). FARRIER, C. W. **Housing as a postwar opportunity—its techniques. Technical developments.** *Rep. 5th Vermont Wood Prod. Conf.* 1945 (27–36). P.R.

A general account of the housing situation in the United States, containing brief summaries of developments in the uses of wood in building and in prefabrication.

33.5. *Pitprops. Sleepers. Poles and Other Roughly Converted Wood*

[531]. 33.51 : 32.25.3. MANG, J. Schlechte Entästung des Grubenholzes. [**Inadequate trimming of pitwood.**] *Glückauf* 79 (37/38), 1943 (443). [G.] L.S.

A short article on the necessity for trimming pit props adequately, since badly lopped timber increases the likelihood of accidents to miners.

[532]. 33.51 : 32.25.5. MANG, J. Grubenholz mit Rinde. [**Pitwood with bark.**] *Glückauf* 79 (29/30), 1943 (363–4). [G.] L.S.

A discussion of the advantages and disadvantages of barking softwood for pit constructions. Danger from attacks by bark beetles and seasoning difficulties make it advisable for all but small and thin props to be completely stripped.

[533]. 33.52 (71). **The requirements of the C[anadian] P[acific] R[ailway].** *Timberman* 47 (1), 1945–46 (58–60).

The Canadian Pacific Railway requires about 3½ million sleepers annually for replacement and new construction. Of these, about 2 million are manufactured in British Columbia, 150,000–200,000 each in Alberta and Saskatchewan, 150,000 in Manitoba, 900,000 in North-west Ontario. Both hardwoods and softwoods are used. One of the principal flaws likely to develop during the seasoning, particularly of hardwood sleepers, is end checking. The extension of end-checking is prevented by the S-iron, a broad S-shaped band of iron which is driven to its full depth of about 1 in. into the ends of the sleeper. About 2,400,000 of the 3½ million sleepers required annually are creosoted.

[534]. 33.52 (72). Uranga L., A. Los ferrocarriles de México y sus abastecimiento de maderas. **[The railways of Mexico and provision for their timber requirements.]** *Bol. Direcc. for. Caza, Méx.* 5 (2), 1944 (1–4). [Span.]

A general discussion on the past, present, and probable future timber requirements of the Mexican railways and measures whereby the railways may ensure a continuance of adequate supplies.

[535]. 33.52 (94). Powell, S. H. **The forest provides our transport.** *Aust. Timb. J.* 11 (12), 1945–46 (602–3, 625).

An account of the sleeper requirements of the various states of Australia and the species most used. Timbers most in demand are *Eucalyptus paniculata*, *E. obliqua*, *E. microcorys*, *E. maculata*.

[536]. 33.53 : 12.25 (73). **Larch poles prove satisfactory.** *Timberman* 47 (2), 1945–46 (90).

Tamarack (*Larix americana*) is being increasingly used for pole and piling material in the Inland Empire region of the United States, owing to the shortage of Western Red Cedar. The poles are incised and then treated with hot creosote and penetrations of ¾–1½ in. are obtained. Examination of Tamarack used as piling in bridges, water towers, ferry towers and river piling that have been in place for 20–30 years, shows that the condition of the timber above ground is excellent.

33.6. *Packing Boxes, Crates, etc.*

[537]. 33.6 (75.9). Callahan, J. **Florida's crate industry.** *Barrel & Box* 50 (8), 1945 (8). P.R.

Notes on the crate industry in Florida, dealing with types of crate and timber used, methods of sawing and seasoning, etc. The author forecasts the wider use of swamp species of Magnolia and second-growth Pine or small Cypress for veneers in areas where Pine is scarce.

[538]. 33.6 : 33.15.2. Thompson, C. J., and Fisher, D. F. **Plywood fruit and produce box.** *Timberman* 47 (1), 1945–46 (86, 88). [U.S. Bureau of Plant Industry, Beltsville, Md.]

The box described in this article was designed and made up at the United States Plant Industry Station, Beltsville, Maryland, in order to conserve steel and facilitate re-use. It was designed for packing apples, but the principle can be applied to the packing of other fresh produce. It is made of resin-bonded plywood secured by means of glued-in hardwood collets with hardwood tapered core-pins. The purpose of the tapered core-pin is to expand the split collet outward, filling the hole into which it is fitted. The dimensions of the box are slightly different from those of standard boxes, in order to make top, bottom, and side members interchangeable, which facilitates re-use and also enables plywood to be cut to advantage. The original cost of this box will probably be somewhat higher than that of ordinary boxes because of the use of plywood, but its value for continued re-use should more than compensate for its higher initial cost.

33.7. *Firewood*

[539]. 33.7 (73) : 31.24. Woodward, K. W., and Kauffman, E. **Wood as a war-time fuel.** *Amer. For.* 48 (10), 1942 (439–43, 477).

[540]. 33.7 : 32.3 : 07.7. Nordsten's Kvasbundter. **[Nordsten's brushwood bundling machine.]** *Dansk Skovforen. Tidsskr.* 25 (6), 1940 (321–2). [Dan.]

Description and figure of a simple machine, weighing only about 40 kg., for making up brushwood in bundles of standard diameter 25 cm. and up to 1½ m. long, each bundle weighing about 15 kg.

[541]. 33.7 : 33.38.2 : 07.7 (489). GANDIL, C. Fremstilling af Generatorbrænde. **[Production of fuelwood for gas generators.]** *Dansk Skovforen. Tidsskr.* 26 (12), 1941 (429–54). [Dan.]

A brief account is given of the introduction (June 1941) of rationing of fuelwood (charcoal was not permitted, as its use would have been too wasteful of the limited wood available) for gas-driven vehicles in Denmark, followed by notes on the manufacture of generator fuel (*a*) by cross-cutting with subsequent hand or machine cleaving; (*b*) conversion by saw throughout, first by a large bandsaw into planks, next by a smaller bandsaw into rough scantlings, and last by a 'Multisav' (a series of circular saws mounted on a common arbor) into the finished billets. Data are provided, so far as available, on out-turn, costs, labour required, etc., for a portable bandsaw, a portable combined bandsaw and cleaving machine, 4 types of cleaving machines, and the 'Multisav' (all figured).

[542]. 33.7 : 33.92. WILLEY, E. C. **Stack losses from wood fuel.** *Heat & Ventilation* 42 (11), 1945 (67). P.R.

Charts designed to show the stack losses in British thermal units per pound of fuel for both wet and dry wood with various percentages of excess air. They have been used in gas analyser demonstrations. The charts apply specifically to Fir with a heat content of 8,750 British thermal units per lb. dry.

33.8. *Other Manufactured Products*

[543]. 33.8 : 01.6 : 31. **List of reports and publications on the use of wood in aircraft construction.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*54, 1943. pp. 11.

[544]. 33.8 : 33.15. HEATH, J. B. **The Mosquito aeroplane.** *Sth. Lumberm* 172 (2156), 1946 (55–7).

Details of the wood construction of the Mosquito aeroplane, with particular reference to the laminated spar construction and dinghy stowage boxes, as manufactured by the Heathland Furniture Works, High Wycombe, England.

[545]. 33.8 (43.1–5). GREY, J. T. **Report on plastics and wooden parts in German aircraft.** *Comb. Intell. Obj. Sub-comm.* Items 4, 5, 25, File XXXI–8, 1945. pp. 13 + i. P.R.

In order to ascertain the new developments in aircraft parts of wood and plastics, the chief engineers of several aircraft companies and one of the leading designers of wooden aircraft in Germany were interrogated. A limited number of selected targets were also investigated. To conserve metal, especially aluminium, and to reduce production times, the German aircraft industry developed several semi-structural and structural parts in wood. The boldest venture in this direction, reported in detail, is the all-wood wing of the He-162. Wooden parts of lesser importance were found on the Do-335 and the F-W 190 and Me-262.

[546]. 33.8. **Cylindrical wood tanks.** *Bull. Acme Tank Mfg. Co., Los Angeles* No. B–45 IML. [n.d.] pp. 23. P.R.

This publication gives standard specifications for cylindrical wooden water-storage tanks, directions for their erection, and a description of covers, register boards and fittings, with illustrations. Tables show measurements and capacity of round and rectangular tanks, and the dimensions, capacity and weight of special Redwood tanks banded for 1·2 and for 1·0 specific gravity.

[547]. 33.8 : 33.15.2. **Small boat constructions without fastenings.** *Aero Res. tech. Notes, Bull.* No. 40, 1946. pp. [2] + plates. P.R.

A description of a light plywood sailing dinghy without metal fastenings constructed by Aero Research Ltd. Details of the construction, which relies upon synthetic-resin glues with some wood-to-metal bonding by the Redux process, are given. A type of light racing skiff constructed by Messrs. H. C. Banham of Cambridge is also described. Glued plywood, replacing Cedar wood, produces a craft of much greater strength and less weight.

[548]. 33.8 : 12.26–8 : 31.2. PAUL, B. H., and BAUDENDISTEL, M. E. **Open-grown Sugar Maple for textile shuttles.** *Sth. Lumberm.* 171 (2153), 1945 (173–6). [Forest Products Laboratory, U.S. Forest Service.]

The Forest Products Laboratory, Madison, carried out tests on open-grown Maple, to determine its suitability as a substitute for Dogwood in manufacturing textile shuttles.

The conditions of its growth, in fields and the more open parts of farm woodlots, are conducive to rapid growth and wide annual rings, and the wood is considerably harder and heavier than forest-grown wood of the same species.

The following results were obtained:—

	Average specific gravity	Average shear strength at 12 per cent. moisture	Average shrinkage from green to oven-dry condition
Open-grown Maple	0·650	2,300 lb./sq. in.	15·7
Dogwood	0·647	2,260 ,,	17·5

In an air-dry condition (12 per cent. moisture content) the open-grown Maple averaged a little harder than Dogwood for both side and end grain. These results show that there is no significant difference between the two species in the properties tested.

[549]. 33.8 : 31.22. Johnson, S. J., and Rasmussen, E. F. **A wood-element hygrostat.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1602, 1946. pp. 9 + tbls. + figs. P.R.

The report gives information on the functioning and construction of wood-element hygrostats. Improvements on the earlier type, in which the curved wood element was disposed to distort and break, are described. The construction of a later type of hygrometer with a straight, free-floating wood element is detailed, with the method of calibrating and operating it. The report includes a table of relative humidities and equilibrium-moisture-content values for use with both dry-bulb temperatures and wet-bulb depressions, and a table of dial settings with corresponding equilibrium-moisture-content values.

[550]. 33.8 : 33.12 : 07.7. **Rifle stocks.** *Timber News* 54 (2081), 1946 (104–5).

An account of how stocks of imported Beech table squares were used for rifle sets during the emergency in 1940. When these stocks were exhausted home-grown Beech was used until imports of American Black Walnut were received under lease-lend arrangements. Home-grown Beech provided difficulties due to the absence of uniformity and to the instability of some of the material after kilning and shaping. Moderate kiln temperatures were found to give the best results. Planks were brought down to an average moisture content of 12½ per cent. An account of some of the machines used (a copying lathe, a three spindle planing-and-grooving machine and a taper-setting machine) is also given.

33.9. *Grading of Converted Timber*

[551]. 33.91 : 33.4. Great Britain. **Grading and sizing of softwood tongued and grooved flooring.** *Brit. Stand.* No. 1297, 1946. pp. 7. P.R.

A specification (B.S. 1297: 1946) covering the grading and sizing of softwood tongued-and-grooved flooring. A list of suitable species is given to which others will be added as they become available. Conditions governing the time of grading, moisture content, sapwood, decay and insect attack, checks and shakes, seasoning defects, knots, wane, rate of growth and manufacture are laid down. [Cf. *For. Abstr.* 8 (Nos. 352, 528–9).]

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. *Vegetable Products*

[552]. 34.2 (489) : 12.14.8 : 35 : 32.25.5 : 07.7. Elmquist, K. Dansk Bark: Egenskaber, Anvendelser og Aftagning. **[Danish bark: properties, uses and removal.]** *Dansk Skovforen. Tidsskr.* 29 (3), 1944 (61–124). [Dan.]

An abridged version of a thesis, largely a review of literature (much German), with 4 chapters: (i) Properties, with notes on general anatomy and technologically important characters in general. (ii) Uses, e.g., as a source of tanstuffs, pharmaceutical preparations, bast, textiles (Dansk Salixindustrie A/S is said to have had promising trial results with a type of Willow 'jute' for matting and other purposes not specified), fuel (the calorific value is not much below that of wood), and miscellaneous.

(iii) Barking, with notes on tools and technique, cleaning, drying and further treatment. (iv) A sketch of production and prices in Denmark (data scanty) from 1875 to 1942. Before the second world war, Danish production was inconsiderable compared with imports, e.g. of Quebracho, though Danish bark could probably have been marketed at competitive prices given improved technique, including machine barking at the mills, and a moderate State subsidy. Post-war prospects are uncertain.

[553]. 34.2 : 12.26–8 (410). Pearson, F. G. O. **The utilization of Alder Buckthorn.** *Forestry* 19, 1945 (95–6). [Forestry Commission and Ministry of Supply.]

A short account of the harvesting and preparation of *Frangula alnus* Miller (*Rhamnus frangula* L.) in Great Britain during the war. The wood is used to make a special charcoal for use in the manufacture of munitions, and the bark and berries in the preparation of purgatives.

[554]. 34.2 : 12.29 (729.1) : 33. Crane, J. C. **The Royal Palm in Cuba.** *Agric. in Americas* 5 (6), 1945 (109–11, 115). A.P.B.

The Royal Palm (*Roystonea regia*) is found in all parts of Cuba except in the higher mountains and in places where the soil is poor and arid. The many uses of the trunk and leaf sheaths are indicated. The fruit kernels have an oil content of about 18 per cent. and are used extensively as feed for hogs.

34.21. Fodder Grass and Grazing

[555]. 34.21 : 43.11 : 11.62.11. Jeffreys, M. D. W. **This burning question.** *Farm and Forest* 6 (3), 1945 (115–24).

The writer criticizes a previous article on Grass-burning in West Africa [see *For. Abstr.* 6 (112)] which condemned such burning on principle and found in it one of the main causes of soil erosion. He argues, on the contrary, that no facts have been adduced in proof of this alleged deleterious effect of grass burning and he cites a number of statements on the subject from very varied sources, to show that burning is not in itself harmful and may be beneficial. His conclusion is that shifting cultivation is the only cause of soil erosion, and that the fact that shifting cultivation is often accompanied by grass burning, has confused investigators.

[556]. 34.21 (54.2). Joshi, K. D. **Management and improvement of grazing in waste lands of the United Provinces.** *Indian For.* 72 (2), 1946 (59–60). [Afforestation Division, U.P.] 6th Silvicultural Conference, Dehra Dun (1945).

The various methods of periodic and rotational grazing regulation which have been tried in the afforestation division of the United Provinces, are described. A comparison of the efficacy of the various methods is not feasible at the present stage because the incidences and closures prescribed can seldom be effectively enforced in practice owing to lack of proper fences and to evasions on the part of local staff and villagers. It is suggested that the State should assume control of neglected lands, but that State control should be relaxed in favour of the local population as soon as *zamindars* and villagers have become convinced of the value of grazing regulation in producing better fodder grasses for their cattle, both for pasturage and stall feeding.

[557]. 34.21 (75 : 76). Campbell, R. S., and Biswell, H. H. **Better management on Southern coastal forest ranges.** *Agric. Inform. Ser. U.S. For. Serv.* No. 17, 1945. pp. 12.

A pamphlet for the instruction of Southern cattle farmers and foresters in the management of forest ranges, based on recent research [cf. *For. Abstr.* 6 (282), 7 (No. 352), 8 (Nos. 558–60)]. Carefully controlled burning may be practised in the Longleaf type but not outside it. Cattle on forest range need protein supplements in late autumn and winter, and mineral supplements, especially phosphorus, all through the year. It is emphasized that fenced control of cattle is vital in good range management.

[558]. 34.21 : 12.25 : 12.26–8 : 24.31 (75 : 76) : 44.1. Campbell, R. S., and Peevy, F. A. **Grazing values on Southern Pine lands reduced by hardwood invasion.** *Sth. Lumberm.* 171 (2153), 1945 (230, 232, 235). [U.S. Forest Service.]

The invasion of Pine lands by low-value hardwoods in the Southern Pine region is a serious hindrance to forest grazing as well as to timber production. The commonest and most damaging species is Blackjack Oak (*Quercus marilandica*). Other common species are *Q. cinerea*, *Q. stellata margaretta* and *Q. laevis*. Scrub hardwoods greatly reduce the amount of forage available, besides shading out Pine reproduction. Measurements were made in a Pine/hardwood area grazed by cattle in Central Louisiana, where there are 2 types: (1) open cut-over Pine with grass and practically no hardwoods; and (2) Blackjack Oak/grass. The production of green herbage on the two types at different seasons of the year is shown in the following table:—

HERBAGE PRODUCTION, AIR-DRY, 1944

Month	*Open grass type lb. per acre*	*Oak/grass type lb. per acre.*
February .	250	200
May . .	1,050	855
August . .	1,840	950

Chemical tests have so far shown no significant differences in the nutrient values of native forage in open grass and in Blackjack types. Scrub Oaks also make inaccessible some of the herbage that does grow, and hinder distribution and handling of cattle on the range.

Care is needed that measures intended to control hardwoods do not actually make them spread. There are some areas on which timber stand improvement was undertaken some years ago through girdling or cutting Blackjack Oak, where hardwoods have since increased considerably through re-sprouting. Although fires do set back the Oak, they rarely kill the entire stand; at the same time, repeated burning wipes out young Pine reproduction. Repeated cutting of sprouts appears to be quite ineffective. Goats have been used locally as a temporary expedient to clean out underbrush where adequate Pine seed-trees remained. Many attempts have been made to control sprouts by mechanical methods such as tractor-operated saws, heavy discs, bulldozers and brushcutters, but there is always considerable sprouting. The Southern Forest Experiment Station has done much experimenting with chemical control of Oak. By 1942, a standard method was evolved, using sodium arsenite, which is injected into the main roots of trees near the root collar with a hole-punching axe [see *For. Abstr.* 4 (105)]. There are several objections to using sodium arsenite: it is dangerous to handle, being a deadly poison to both animals and plants, and though it kills the main trunks of trees there may be some re-sprouting, especially if the work is done carelessly. Further studies are now in progress on Blackjack Oak with ammonium sulphamate, 2,4-dichlorophenoxyacetic acid, diesel fuel oil, creosote and sodium arsenite. Methods of application include holes in the trunk, frills, basin, poisoning stumps of felled trees, and spray on sprouts and small trees. Preliminary results of one year's treatment look promising, particularly those from spraying solutions of ammonium sulphamate and of 2,4-dichlorophenoxyacetic acid on scrub Oak sprouts, but past experience has shown that there may be re-sprouting in the second year from trees thought dead. [Cf. *For. Abstr.* 8 (No. 274.]

[559]. 34.21 (75.8). LEMON, P. C. **Prescribed burning in relation to grazing in the Longleaf-Slash Pine type.** *J. For.* 44 (2), 1946 (115–7). [Appalachian Forest Exp. Sta., Asheville, N.C.]

Studies in the Longleaf/Slash Pine type in Southern Georgia show that prescribed burning improves the forage for grazing and results in increased cattle gains. Observations indicate that prescribed burning may also be beneficial in fire-hazard reduction, seedbed preparation, and for control of brown spot disease. The following table shows gain per steer in relation to the amount of newly burned range available, March 9 to October 19, 1944.

Acres per steer		*Pounds gained*
New burn	*Old burn*	*Per steer, 225 days*
0·0	8·0	43·2
2·7	5·3	64·4
4·0	4·0	82·2
8·0	0·0	102·2

Prescribed burning to improve grazing can be successfully done without excessive tree damage under Southern Georgia conditions, if the area selected for burning has an adequate stand of trees capable of withstanding light fires, if it is subdivided into small units by natural or artificial firebreaks, if conditions for burning are carefully considered, and if the job is done by men trained in the skilful use of fire as an agent in good forest management. It is stressed that careful advance planning and extreme care are necessary in using fire in this way. [Cf. *For. Abstr.* 4 (54), 7 (No. 352).]

[560]. 34.21 (76.3) : 97.3. Campbell, R. S., and Rhodes, R. R. **Forest grazing in relation to beef cattle production in Louisiana.** *Bull. La. agric. Exp. Sta.* No. 380, 1944. pp. 43.

The results of a survey of 118 cattle-producing farms on forest range in Louisiana [see *For. Abstr.* 7 (No. 352)].

[561]. 34.21 (79.4). Hormay, A. L. **Palatabilities of foothill range plants for cattle.** *For. Res. Note Calif. For. & Range Exp. Sta.* No. 25, 1940. pp. 4.

Data in the form of percentage palatability (rounded to the nearest 10 per cent.) for the annual type vegetation (grasses, grass-like plants and forbs) which covers about 25 million acres mainly below 2,500 feet in California, and for about 35 species of shrubs and trees occurring in the same region.

[562]. 34.21 (79.4). Hormay, A. L. **Bitterbrush in California.** *For. Res. Note Calif. For. & Range Exp. Sta.* No. 34, 1943. pp. 13.

Bitterbrush (*Purshia tridentata*) is one of the most important range plants over 340 million acres in the Western United States. It is rather intolerant of shade and the densest stands are found in forest openings and clearings and on slopes below the Pine forest. Over large areas it has been destroyed or damaged by fire, heavy grazing by livestock and game, defoliation by caterpillars, girdling by rodents, etc. and in many places is not perpetuating itself. Over-grazing is probably the principal cause of deterioration and it is estimated that 40 per cent. of twigs should remain on the plant each season to insure adequate seed production and good plant vigour. Artificial re-seeding trials offer considerable promise for the re-establishment of Bitterbrush on many sites where it has been destroyed.

[563]. 34.21 : 97.3 (79.7). Arnst, A. **Forage crops on J. Neil's cutover land.** *Timberman* 46 (12), 1944–45 (68, 70, 72–3, 76).

An account of a grazing programme designed and carried out co-operatively in Klickitat County, Washington by a lumber company, local graziers, the Soil Conservation Service and the College of Forestry of the University of Washington. It was recommended in 1938 by the College of Forestry that 30,000 acres of cut-over land belonging to the company should be retained for timber production and that the leased forage resource should go far towards paying the annual cost of fire exclusion and taxation. Under existing grazing practices, however, the range resource was being dissipated, tree reproduction was being browsed or trampled and erosion was beginning. Mismanagement had depleted 85 per cent. of the range's vegetative types and another 12 per cent. was in still poorer condition. Carrying capacity averaged about 14 acres for a sheep season or 70 acres a cow season.

The programme of range management worked out by the various interested parties provided for the improvement of watering facilities by installation of drinking troughs or digging out basins at springs, construction of fences round the managed areas and cattle guards across public roads crossing the area, and cattle corrals at specific points. Leases stipulated that livestock was to be grazed according to prescribed allotments and a programme worked out by the Soil Conservation authority. A stock reduction of about 2,000 sheep and 100 cattle and a restricted grazing season of 4½–5 months was provided for. Spring turnouts were to be gauged by vegetative readiness and before stock could be turned out, perennial forage grasses were to have 6–8 in. of new growth and major browse species were to be in full leaf and beginning new twig growth. In 1939 a demonstration reforestation plot was established on a double burn area lacking seed trees.

The programme involved a cash outlay of several thousand dollars; lessees paid half the cost of spring and well development and agreed to keep in repair all company-built fences and to build all corrals.

Current field observations indicate some preliminary conclusions. Undoubtedly some type of range management is needed to sustain the forestry programme; on the other hand, controlled grazing will not injure the forest resource and has certain advantages, such as reducing flash fuels of dried grass and herbs which feed ground fires, preparing a better seedbed for natural reproduction, and developing cattle paths which may be useful in controlling ground fires. Controlled grazing should allow adequate natural re-stocking on both clear-cut and selectively cut areas. Ponderosa Pine plantations on denuded areas will require from one to three years of closure to grazing to give the seedlings the start they need. This is confirmed by the 1939 reforestation plot which has received complete protection. The trees in this plot are now 8–10 ft. high with 1- to 2-ft. leaders, and a thick carpet of vigorous grasses covers the ground. Outside this fenced area the ground is soured and trampled and the few scattered seedlings have been browsed to the ground. It is clear that the poor re-stocking of much of this clear-cut area has been largely due to overgrazing and mismanagement of stock, and that controlled grazing will permit seed trees to reforest much of the land.

34.23. Wood Ash. Potash

[564]. 34.23 : 12.26–8. KHUKHRYANSKI, P. N. Berezovaya drevesnaya zola vzamen kausticheskoy sodȳ. [**Birch wood ash as a substitute for caustic soda.**] *Lesnaya Prom.* No. 1/2, 1945 (24). [Russ.]

A lye, suitable for use instead of the 10-per-cent. caustic-soda solution normally used to remove grease from files, may be prepared by adding Birch ashes to water (250–300 g. per litre), boiling for 2–2½ hours, leaving at room temperature for 8–10 hours to allow insoluble material to settle, and straining. The lye has a soapy feel. Files are cleaned by immersing for 10–15 minutes at 50–60° C. This method was successfully used and is now normal practice in a forest district of the Tartar A.S.S.R. Pine and Spruce ashes do not yield a soapy lye, but Aspen does and might possibly be used as well as Birch.

34.24. Tanning Materials. Cork

[565]. 34.24. BLAIR, M. G., and PEFFER, E. L. **Thermal-density coefficients and hydrometer correction tables for vegetable tanning extracts.** *J. Res. nat. Bur. Stand.* 33 (5), 1944 (341–51). L.S.

Densities and thermal expansions have been determined of the vegetable tanning extracts—Quebracho, Oak bark, Hemlock bark, Chestnut, and Mangrove bark—within the range 1·00 to 1·12 sp. gr. at 60°/60° F. and over the temperature range 50° to 100° F. Thermal-density coefficients are presented in such a manner that the density of an extract at any temperature within the range can be calculated if its sp. gr. at 60°/60° F. or its density at 25° C. is known. The information obtained has been used also in the preparation of tables for correcting hydrometer readings at observed temperatures in degrees barkometer, in degrees Twaddle, and in degrees Baumé to readings at the standard temperature 60° F. *Authors' summary.*

[566]. 34.24 (489). Den danske Garve-extrakt-Fabrik i Hillerød. [**The Danish tannin-extract factory at Hillerød.**] *Dansk Skovforen. Tidsskr.* 29 (12), 1944 (511–9). [Dan.]

This emergency factory, established at the request of the majority of the Danish tanneries, began work in autumn 1942, using as raw materials (percentage contents of tanstuffs in parenthesis)—(*a*) Oak stumps (8) and a small quantity of Spanish Chestnut wood (12); (*b*) Conifer barks, summer-harvested and dried, mostly Norway Spruce (12), with some Sitka Spruce (23) and Silver Fir (6), all of about 20 per cent. moisture content; (*c*) the same conifer barks, undried (about 50 per cent. moisture), mostly from woods and sawmills in N. Sjælland. After mechanical reduction, the raw materials pass to a battery of 12 extractors and extraction is done with distilled water steam-heated to about 99° C., which passes successively through 10 extractors (4 hours in each) and is then pumped off at a concentration of about 3° Baumé to storage tanks. This product is then concentrated to 25° Baumé in evaporators to give the final extract ready for the tanneries. Steam heat for the plant is provided by tubular boilers, with a Ljungstrøm air heater, which are run, apart from about 5 per cent. of imported fuel, exclusively on the compressed waste from the extractors. The plant works a 24-hour day and in this period uses about 50 stacked cu.m. of Oak stumpwood and 10 metric tons of conifer bark. The maximum output would supply about 45 per cent. of Denmark's normal consumption of tanstuffs. Though established in the first place for war-time conditions, it is hoped that operation will continue after the war. [Cf. *For. Abstr.* 8 (No. 552).]

[567]. 34.24 (75). RUSSELL, A., with associates. **Natural tanning materials of the Southeastern United States: VIII. Mountain species.** *J. Amer. Leath. Chem. Ass.* 40 (11), 1945 (422–6). L.S.

A survey was previously carried out on the species of trees containing tannin materials in the Southeastern United States [cf. *For. Abstr.* 6 (p. 250); and 7, (No. 1356)]. Thirty-five more species in 22 genera are now presented. Six of these species did not contain tannin in either the wood or the bark, 22 contained it in the bark only, 7 had it both in the wood and in the bark. *Castanea mollissima* contained tannin in both the wood and the bark. The results of the investigation are given in tabulated form showing the character and colour of the leather obtained. *C. pumila* (Allegheny Chinquapin) and *C. dentata* (American Chestnut) were only very young trees and the tannin content of the wood was therefore much lower than the usual value.

[568]. 34.24 : 12.26–8 (54). EDWARDS, M. V. **The vegetable tanning materials of India. Part III—Babul (*Acacia arabica*).** *Indian For. Leafl.* (*Chem. and minor For. Prod.*) No. 74, 1945. pp. 21. [Forest Research Institute, Dehra Dun.]

A summary of available information on Babul (*Acacia arabica*), its varieties and distribution. Tannin content and yield of the bark and pods are detailed separately. Methods of collection, preparation for market, tanning properties and manufacture of the extract are discussed. Silviculture and the relation of the use of the bark and timber are briefly dealt with. The author concludes that Babul, as a source of tannin, may be supplemented by Wattle because of the diminishing reserves of Babul and the failure to utilize and market it satisfactorily. *From author's summary.* [Cf. *For. Abstr.* 7 (1961); 8 (No. 166).]

[569]. 34.24 : 12.26–8 (54). EDWARDS, M. V. **The vegetable tanning materials of India. Part V—Black Wattle (*Aacia mollissima*).** *Indian For. Leafl.* (*Chem. and minor For. Prod.*) No. 76, 1945. pp. 22. [Forest Research Institute, Dehra Dun.]

This compilation summarizes available information on the Black Wattle (*Acacia mollissima*), with notes on other Wattles growing in India and their tannin content. Details are given of analyses, variations in tannin content, and, for Black Wattle, the yield of bark in South Africa and Java and probable yield in India. Methods of collection, preparation for market, tanning properties and manufacture of extract are briefly dealt with, and statistics of South African production, Indian imports and prices and world use of Wattle and other tanning materials are given. The importance of by-products is emphasized and the silviculture of the tree is briefly explained. It is concluded that Indian-grown Wattle could be made of equal tanning value to South African bark, but research is necessary on production and marketing methods, so that a comparable product can be prepared. *Author's summary.*

[570]. 34.24 : 12.26–8 (81) : 21.0. Acácia negra. **[Black Wattle.]** *Brasil madeireiro* 1 (5), 1945 (15). [Port.]

The tannin-producing exotic, *Acacia decurrens*, can be grown with advantage in Brazil as a substitute for imported Quebracho. A brief account is given of the planting and care of Black Wattle plantations and of the extraction of the tanbark. The wood of *A. decurrens* is suitable for mechanical pulp and for paper manufacture.

[571]. 34.24 : 12.26–8 (54) : 34.26. KRISHNAMURTI, G. V., and SESHADRI, T. R. **A note on the phlobatannins of Kino and Butea gums.** *Proc. Indian Acad. Sci.* 22A (3), 1945 (134–7). L.S.

The phlobatannin components of Kino gum (*Pterocarpus marsupium*) and Butea gum (*Butea frondosa*) were purified and rendered free from water and ether-soluble impurities. By subsequent methylation and acetylation almost colourless methyl ethers and acetates were obtained. Marked optical activity was shown, thus supporting the idea that the phlobatannins are probably hydroxyflavan derivatives. A comparison of the properties of the phlobatannins from the two sources and of their derivatives indicates that they are identical. *Authors' summary.*

[572]. 34.24 : 12.26–8. CLARKE, I. D., and HOPP, H. **Effect of method of drying on the composition of Dwarf Sumac leaves and on the colour of the leather produced.** *J. Amer. Leath. Chem. Ass.* 40 (10), 1945 (363–78). L.S.

Comparable leaves of Dwarf Sumac (*Rhus copallina*) were dried by ten methods and then subjected to chemical analysis and to tanning tests on sheepskin. The tannin content of separated leaves was not significantly influenced by the rate of drying at ordinary temperatures, but drying leaves still attached to the stems appeared to increase their tannin content, while heat treatment reduced the tannin if heating was prolonged or carried out at high temperature. Sugars, both reducing and total, were definitely affected by the drying method, and these changes appeared to be the main causes of the variations of non-tannins and purity. Brief rapid steaming of the leaves produced light-coloured leather and the study showed that domestic Sumac can be used for the production of light-coloured leather if dried rapidly after harvesting.

[573]. 34.24 : 12.26–8 (51) : 12.12 : 34.25. Yeh, P. C., and Cheng, C. S. **Studies of Chinese gallnuts.** *J. For.* 44 (2), 1946 (121–4). [Department of Agriculture and Forestry, Tien-shui, Kansu, China.]

Galls are formed by several kinds of aphid on a number of Chinese species of Anacardiaceae (*Rhus chinensis*, *R. chinensis* var. *roxburghii*, *R. punjabensis* var. *sinica*, *R. potaninii* and *Pistacia chinensis*). The authors discuss the kinds, distribution, formation, development, constituents and yield of these galls, which have long been used in China for dyeing, tanning, and medicinal purposes. They are now used as a raw material for the extraction of tannic acid, gallic acid and pyrogallol.

[574]. 34.24. Pereira Machado, D. Contribuição para o estudo do método de Capgrand Mothes. [**Contribution to the study of the Capgrand Mothes method.**] *Separate* of *Publ. Serv. flor. Port.* 9 (1), 1942 (115–23 + plates). [Port.f.]

In 1881 Capgrand Mothes patented a method of stripping Cork trees (known by his name) which entailed temporarily re-covering the trunk with its own bark held in place by wires and with the seams caulked. A commercial experiment with a modification of the Capgrand Mothes method done in 1935 and 1936 showed that it can produce cork of higher quality and confer greater vitality on the stripped trees. [Cf. *For. Abstr.* 8 (No. 209, 720).]

34.25. Christmas Trees. Medicinal Plants

[575]. 34.25. **Yule trees last in water.** *Amer. Nurserym.* 82 (11), 1945 (8).

An experiment to test the effectiveness of keeping the butts of Christmas trees in water while in a heated room was carried out at the Ohio Agricultural Experiment Station. Trees standing in water retained their needles for an average period of 21·9 days compared with 12·6 days for the controls.

[576]. 34.25 (76.1) : 11.62.11. Moore, J. C. **Christmas tree production.** *Circ. Ala. agric. Exp. Sta.* No. 92, 1945. pp. 15.

Arizona Cypress (*Cupressus arizonica*), Red Cedar (*Juniperus virginiana*), Scrub Pine (*Pinus virginiana*), and White Pine (*Pinus strobus*) give promise of making good Christmas trees when grown in Alabama and the South-east as erosion-control covers on sloping lands where cultivated crops are inadvisable. These and 11 other species of conifers were tested in contour rows at 4-ft. spacing (2,700 to the acre) in combination with (i) native vegetation, (ii) partridge peas, (iii) *Lespedeza sericea* and (iv) crimson clover and fescue grass. All combinations control erosion but better tree growth is given by (iv) which is a winter/early-spring crop dying in summer and forming a heavy mulch. Top-renewal studies show that several Christmas trees can be cut from one stump by allowing it to coppice and training or pruning the shoots.

[577]. 34.25 : 12.26–8 : 21.0 : 12.19. Carvalho, A., and Krug, C. A. A quineira (*Cinchona* sp.). Origem, classificação, exploração econômica no mundo e tentativas de sua aclimatação no Brasil. [***Cinchona* sp. Origin, classification and world economic exploitation, and attempts at acclimatization in Brazil.**] Instituto Agronômico do Estado de São Paulo, Campinas, Brasil. 1944. pp. 141. [Port.]

A comprehensive survey dealing briefly with: history of the medicinal use of quinine; the principal expeditions to the Andean zone to study *Cinchona* spp; botanical classification of *Cinchona* (including a list of known species, subspecies and varieties); geographical distribution of the endemic species; soil and climatic requirements of *Cinchona*; centres of quinine production and experimental plantings of *Cinchona* in various parts of the world; cultivation (including methods of propagation and culture); the distribution of alkaloids in the plant; pests and diseases; extraction of the quinine; the problem of malaria in Brazil and attempts to acclimatize *Cinchona* in the state of

São Paulo. A bibliography of 80 titles is appended. [Cf. *For. Abstr.* 8 (No. 103).]

[578]. 34.25 : 12.26–8 (84 : 85 : 86). Carvalho, A. Viagem aos centros de origem da quineira (*Cinchona* sp.) (Bolívia, Perú, Equador, Colômbia) 1939–40. **[Expedition to the centres of origin of *Cinchona* (Bolivia, Peru, Ecuador, Colombia) 1939–40.]** Instituto Agronômico do Estado de São Paulo, Campinas, Brasil. 1944. pp. 108. [Port.]

[579]. 34.25 : 12.26–8 (85). Hodge, W. H. **Synopsis of the Cinchonas of Peru.** *Bol. Mus. Hist. nat. Javier Prado, Lima* 8 (30/31), 1944 (171–97). [Massachusetts State College.] Chem. Abstr. 40, 1946 (431). P.R.

Mainly botanical and ecological. Values are given for the total crystallizable alkaloids, quinine and other alkaloids of the bark of several species of the genera *Cinchona* and *Ladenbergia*.

[580]. 34.25 : 12.26–8 (85) : 12.11.11 : 12.14.8. Hodge, W. H. **Alkaloid distribution in the bark of some Peruvian Cinchonas.** *Carib. For.* 7 (1), 1946 (79–92). [E. Span.e.span.f.]

The analyses of selected bark samples of wild Cinchona trees growing in Peru indicate that alkaloid content varies appreciably in ascending from the base of a tree towards the top. In some types of Cinchona, alkaloids are higher in quantity at the base of the trunk than in the upper parts of the tree, while in other types a reverse condition exists. Samples of wild trees taken for the purpose of estimating commercial yields must therefore include bark from these two parts of the tree. A relationship also appears to exist between the quantity of alkaloids present in a tree and the girth (or age) of the tree. Alkaloids either increase or decrease in quantity with increase in girth of the tree, and this increase or decrease depends upon the alkaloid and the type of Cinchona involved. *Author's summary.*

[581]. 34.25 : 12.26–8 (86). McComb, A. L. ***Cinchona officinalis* in the Colombian Andes.** *J. For.* 44 (2), 1946 (92–7). [Iowa State College, Ames, Iowa.]

A description of *Cinchona officinalis*, its site requirements, yield of bark, and the alkaloid content of the bark in the eastern Cordillera of the Colombian Andes.

[582]. 34.25 : 12.26–8 : 12.14.8 (86). Martin, W. E., and Gandara, J. A. **Alkaloid content of Ecuadoran and other American *Cinchona* barks.** *Bot. Gaz.* 107 (2), 1945 (184–99). [Estación Experimental del Ecuador and Foreign Economic Administration, Quito, Ecuador.] O.B.D.

Data are presented on the geographic distribution and the approximate composition of the principal commercial *Cinchona* barks of Ecuador, together with the comparative composition of other American barks. Alkaloid-ratio diagrams for the principal *Cinchona* types are presented to show the relative composition of a bark with respect to its alkaloid constituents. These diagrams appear to offer a simple graphic method of presenting genetic variability within a population and may be used as an aid in variety or species delimitation. *From authors' summary.*

[583]. 34.25 : 12.26–8 (81). Machado, O. Contribuição ao estudo das plantas medicinas do Brasil—'*Maytenus obtusifolia*' Mart. **[Contribution to the study of the medicinal plants of Brazil—*Maytenus obtusifolia* Mart.]** *Rodriguésia* 9 (18), 1945 (9–15 + plates). [Port.]

Maytenus obtusifolia grows up to 30 m. high on sandy and clayey soils in coastal regions of Brazil. The histology and chemical composition of the leaf are described and its medicinal properties and uses are briefly reviewed.

[584]. 34.25 : 12.26–8. Wellman, F. L. **Balsam of Peru from El Salvador.** *Agric. in Americas* 5 (5), 1945 (86–8). A.P.B.

Description of the methods commonly employed in tapping Balsam (*Myroxylon balsamum*) in El Salvador and in the extraction of the balm, which is used in medication and in compounding, blending and fixing fine perfumes.

34.26. Resin. Gums. Turpentine. Oils. Rubber. Latex. Gutta-percha. Sugar

[585]. 34.26 (74). Aries, R. S. **Extractives of Northeastern woods.** *Bull. Ntheast. Wood Utiliz. Coun.* No. 6, 1945. pp. [12]. P.R.

A general review of types and properties of wood extractives with special reference to the potentialities of the woods of the north-eastern region of the United States. The constituents and properties of extractives from some species are given in tabulated form.

[586]. 34.26. MAS-GUINDAL, J., and MAS-GUINDAL, A. Plantas productoras de esencias, resinas y sus derivados: descripción, composición, aplicaciones, etc. **[Plants producing essential oils, resins and their derivatives: description, composition, uses, etc.]** Sección de Publicaciones, Prensa y Propaganda, Ministerio de Agricultura, Madrid. 1944. pp. 310. [Span.] Price 3 pesetas.

Sections on (1) oil-producing plants (pp. 9–199); (2) resin-producing plants (pp. 200–251); (3) plants producing oleoresins (pp. 252–264); (4) plants producing gum resins (pp. 265–281); and (5) balsam-producing plants (pp. 282–291).

The first section deals with the plant organs secreting essential oils, general distribution of oils in families or genera, oil extraction, their character and chemical composition, Spanish and exotic oil-producing species (under families), and the cultivation of aromatic plants. A world list of families and genera of oil-producing plants is appended.

Section (2) covers the classification and physico-chemical analysis of the resins, and Spanish and foreign resin-producing plants (including a note on the distribution of *Pinus* spp. in Spain).

The sections dealing dealing with oleoresins, gum resins and balsams comprise notes on chemical composition and on the species. A short list of the industrial and therapeutic uses of resins and their derivatives is appended.

[587]. 34.26 : 12.26–8. RANGEL, J. L. Goma de angico. **[Angico gum.]** Instituto Nacional de Tecnologia, Rio de Janeiro. 1943. pp. 29 + index. [Port.]

The general properties, chemical composition, and industrial and other uses of the gums of *Piptadenia colubrina* Bth., *P. macrocarpa* Bth., *P. cebil* (Griseb.), and *P. rigida* Bth.

[588]. 34.26. SIMÃO, J. Subsídios para o estudo da influência de alguns factores na produção de resina. **[Aids in studying the influence of some factors on resin yield.]** *Publ. Serv. flor. Port.* 8 (1), 1941 (5–57 + plate). [Port.port.e.]

Observations restricted to d.b.h., height and width of crown in relation to resin yield, obtained from 90 trees (tapped by the French system) in the State forest of Leiria, were insufficient to explain more than about 55 per cent. of the total variation in resin yield.

[589]. 34.26 : 12.25 (47.2) : 8. WEGELIUS, T. Kådtappning i Fjärrkarelen. **[Resin-tapping in the Karelian Republic.]** *Svenska SkogsvFören. Tidskr.* 42 (1), 1944 (46–55). [Sw.]

A detailed account is given of the organization and technique of resin-tapping in the Karelian Republic, which had a normal annual output of about 500,000 kg. of resin collected from some 300,000–350,000 Pine trees in 40 tapping districts, each under a special master resin-tapper. From the Swedish point of view the existence of such an industry at latitudes comparable to those of Sweden is interesting, but it is questionable whether the methods used would give a Swedish product capable of competing in price with stump resin or that scraped from Spruce stems. The Russian industry is favoured by the absence of competition from imports and the low wage levels of the country. If Sweden is to produce home-grown resin in greater quantity, modern German technique is likely to be more economical and should be worth trying.

[590]. 34.26 : 12.25 : 12.11.3. MIROV, N. T. ***Pinus*: a contribution of turpentine chemistry to dendrology and forest genetics.** *J. For.* 44 (1), 1946 (13–6). [Institute of Forest Genetics, California Forest and Range Exp. Sta., Berkeley, Calif.]

The writer begins with a résumé of the present state of knowledge of turpentine composition. Most of the world's supply of commercial turpentine is derived from *Pinus caribaea*, *P. palustris* and *P. pinaster*; these 3 species produce turpentine not only in abundance but also of a very simple chemical composition, while other species are much more complicated. Present knowledge of Pine turpentines is still far from complete. There are about 70 species of the genus *Pinus*, and the turpentine composition of only about 30 species has been investigated. The composition of turpentine obtained from many trees of a given species is fairly constant, but several factors are apt to interfere with the specificity of turpentines. There may be freak Pines whose turpentine differs sharply from the general run of turpentine from other trees of the same species. When two species of Pine are crossed, the chemical characteristics of the turpentine of the hybrid are likely to be more complicated than the turpentines of its parents. Very little is known yet about the inheritance of chemical composition of turpentine in Pines. The writer knows of a Ponderosa × Jeffrey hybrid that contained in its turpentine both terpenes inherited from the Ponderosa parent and heptane from the Jeffrey parent.

Another complication is found when large populations of a Pine species are studied. The composite batches of oleoresin collected from the Pacific Coast form of Ponderosa Pine yield laevorotatory turpentine, but when individual trees are examined a dextrorotatory form can occasionally be found.

One thing appears to be certain: each Pine species as a whole has a specific turpentine by which the Pine can be easily identified. Of all Pines examined, only Jeffrey Pine [*P. ponderosa* var. *jeffreyi*] and Digger Pine [*P. sabiniana*] have almost identical 'turpentines', but even in these two there are some clear-cut specific differences.

On the other hand, it sometimes happens that varieties of a Pine species have turpentines of different chemical composition; e.g. that of *P. ponderosa* is laevorotatory and that of *P. ponderosa* var. *scopulorum* is dextrorotatory. The Pacific and Rocky Mountain forms respectively of Lodgepole Pine and Douglas Fir are also probably different. It is possible that some ancient genetic tendencies are reflected in the chemistry of turpentines, and, when further explored, these differences will be a definite aid to the taxonomist in delineating the phylogenetic relationships of the genus, which will in turn be of use to the geneticist.

[591]. 34.26 : 12.25 : 60.3. McCulley, R. D. **Forest management trends in the naval stores region.** *Sth. Lumberm.* 171 (2153), 1945 (220, 222, 224). [Southern Forest Exp. Sta.]

Timber management in the turpentining region can be divided into 3 classes: (1) management based almost entirely on resin production; (2) a type of management in which turpentining rights are leased and cutting, though still largely a salvage operation, furnishes a large part of the income; (3) on a small area, management for timber production alone. There are two practices which have come to be accepted as good business on lands under all three of these forms of management: improvement cutting and conversion to Slash Pine (*Pinus caribaea*), which bears seed oftener and more abundantly than Longleaf Pine (*P. palustris*), produces more resin, grows more quickly, tolerates more competition from other trees, and is not much affected by brown-spot needle blight. It is much less fire-resistant than Longleaf Pine, and the very great increase in reproduction following fire exclusion has been largely instrumental in converting landowners to conservative management.

There is now a tendency towards shorter turpentining cycles, which is helped by recently developed methods of chemical stimulation. The general practice has been to cup all trees, usually to the 9-in. diameter limit permitted by the Naval Stores Conservation programme, but this is obviously incompatible with good timber-growing practice, and some managers are now experimenting with the chipping only of selected trees. In stands which need thinning, only the trees which should be cut are worked for turpentine.

[592]. 34.26 : 12.25 : 33.32.1. Skolnik, H., and Snow, A. G., jr. **Resin impregnation of catfaces.** *Paper-Tr. J.* 122 (12), 1946 (52–3). P.R.

Resin impregnation resulting from current turpentining practice renders the turpentined 'catface' portion of turpentine-producing Pines undesirable for paper pulp, thus preventing the full utilization of two of the most important Southern species, the Slash and Longleaf Pines. Recent research, however, has developed new methods of turpentining which apparently do not increase the resin content of the butt log beyond the limits of acceptability for pulp. Preliminary data on catfaces so produced are presented in this report. *From authors' summary.*

[593]. 34.26 : 46 : 31.8. True, R. P., and McCulley, R. D. **Defects above naval stores faces are associated with dry face.** *Sth. Lumberm.* 171 (2153), 1945 (200–2, 204). [U.S. Bureau of Plant Industry, Lake City, Fla.]

Pitch-soak, stain, dry wood, and rot are frequently found in Pine in the log cut from just above faces worked out for turpentine and resin. These defects are most pronounced above faces that have been burned, but are also found above unburned faces. The study reported in this paper was carried out to determine how important dry face is as a forerunner of the above-mentioned defects, and it was found that most of them occurred above those faces or parts of faces that had been affected by dry face at the time chipping was stopped. The prompt felling of worked-out timber would limit the spread of pitch-soak and prevent the development of extensive rot; it would not reduce losses due to stain. If a practicable means of preventing dry face in turpentine stands were known, stain, drywood, and rot defects could be practically eliminated above the faces of unburned worked-out timber. *From authors' summary.*

[594]. 34.26 : 12.25 : 34.25. DOLINSKAYA, T. YU., et al. Pikhtovoe maslo kak insektitsid. [**An oil from *Abies* as an insecticide.**] *Zhurn. Mikrobiol. Epidemiol. Immunobiol.* 1944, No. 3 (76–9). [Russ.] L.S.

An oil obtained from the dry distillation of fresh *Abies* twigs plus needles was proved by laboratory and practical tests to be of insecticidal value against lice. The oil is a colourless liquid of specific gravity 0·865–0·952 at 15° C., volatile even at room temperature, and with a pleasant coniferous odour. Its percentage composition is bornyl acetate 40, borneol 5, xanthene up to 4, camphene about 10, α-philandrene and dipentane 6 per cent., plus a little pinene. Applications and dosages are discussed.

[595]. 34.26. **Is Makita oil a commercial possibility?** *Paint Mfr.* 25 (12), 1945 (356). D.S.I.R.

A vegetable oil company in Fiji has started experiments with the treatment of a locally grown nut called 'Makita', believed to be similar to Oiticica. In view of the possibility of using the oil for paint drying, information available on previous studies is briefly reviewed. The nut also grows in West Africa and an analysis of the oil gave the following figures:—

Specific gravity at 10.0-15.5°C.	0.9025
Refractive index at 40°C.	1.5429
Melting point (open tube method)	37.1°C.
Acid value	33.8
Saponification value	193.7
Iodine value (Wijs)	202.8 per cent.
Unsaponifiable matter	1.2 ,, ,,

These properties seem to present no obstacle to its use as a substitute for Oiticica but the main difficulty is in the expression of the oil, which oxidizes readily in air and would therefore necessitate the carrying out of the process under special conditions.

[596]. 34.26 : 12.26–8 (82). Investigaciones sobre las plantaciones de tung en el pais. [**Investigations on Tung plantations in Argentina.**] *Maderil* 18 (4; 5), 1945 (10; 22). [Span.]

A brief report of investigations carried out by the Dirección de Estadística del Ministerio de Agricultura in collaboration with certain other bodies on Tung (*Aleurites fordii*) production in Argentina. Data are given on the area covered by Tung plantations in Argentina in 1944; the total number of trees planted; the number of trees actually in production; and the producion of dried fruits (in kg.) in that year. Other tables show the increasing number of Tung trees planted in Argentina between the years 1937 and 1944 and the relative number and area of plantations held by land owners, lessees, and occupants of fiscal and private lands. Ninety-six per cent. of the Tung plantations of Argentina (representing 41,674 hectares) are in the Province of Misiones.

[597]. 34.26 : 12.26–8 : 21.0 : 23.26 (54 : 59.1). BISWAS, K. **Cultivation and systematic study of the Tung oil yielding trees in India.** *J. sci. industr. Res., India* 4 (5), 1945 (260–72). I.H.

Aleurites fordii and *A. montana* have been grown experimentally in India and Burma. Records of cultivation in India (as a result of experiments on Tung tree seeds distributed from the Royal Botanic Garden, Calcutta in 1931–32) indicate that only in a few areas (chiefly the lower ranges of the comparatively well drained regions of north-eastern India and northern Burma) does it seem likely that successful cultivation of Tung will be possible on a commercial scale.

The author compares the cultural requirements of *A. fordii* and *A. montana* and discusses the vegetative propagation of these species, the biology of the flowers (with particular reference to sexual behaviour), and the general method of cultivation to be followed in India (including nursery practice, transplanting, manuring, fruit collection, husking, and the extraction of the oil).

Maps show (1) distribution of Tung-oil-yielding trees in Eastern Asia; and (2) the areas in India where four commercial species of

Aleurites (*A. fordii*, *A. montana*, *A. moluccana*, and *A. trisperma*) are under cultivation.

[598]. 34.26 : 12.26–8. Romero C., S.A. Posibilidades industriales: el *Anacardium rhinocarpus* D.C. [**Industrial possibilities: *Anacardium rhinocarpus* D.C.**] *Agric. venez.* 8 (95/96), 1944 (34–6). [Span.] A.P.B.

An outline of the main characteristics and uses of Mijaguo (*Anacardium rhinocarpus*). In addition to its timber, the tree yields an edible oil of potential economic importance from its fruits, and the fruit kernel is a valuable animal fodder. Data are included on the chemical composition of the fruit and the physico-chemical properties of the oil.

[599]. 34.26 : 12.26–8 (54). Krishna, S., Kamath, H. R., Kudva, K. T., and Kudva, K. G. **Cinnamon-leaf oil.** *J. sci. industr. Res., India* 4 (8), 1946 (464–6). [Forest Research Institute, Dehra Dun, and Research Laboratories, Cardol Corporation, Mangalore.] I.H.

Eugenol, used extensively in perfumery and pharmacy, is derived mainly from Clove oil, but additional supplies may be obtained from the leaf oil of *Cinnamomum zeylanicum*, which contains 70 to 90 per cent. of eugenol. At present the collection of leaves in South India consumes much time and labour since the oil-yielding varieties of Cinnamon occur scattered in the forest. The present method of distillation is also wasteful. Although investigations are needed on the most suitable strains yielding both bark and leaves of high quality, even coarse bark is of value, as its distillation would provide a source of employment for local distillers when the season for the distillation of the leaf oil is over. The yield of oil from Cloves is 14 to 21 per cent. as against 2 per cent. from dried Cinnamon leaves; but an abundance of leaves at low cost should make up for the poor yield.

[600]. 34.26 : 12.26–8. Sta. Rosa, J. Oleo de favela, nova riqueza da região das secas. **[Oil of Favela (*Jatropha* spp.), a new source of wealth in dry regions.]** Instituto Nacional de Technologia, Rio de Janeiro. 1943. pp. 49 + plates. [Port.]

The booklet deals with: (1) the place of vegetable fats and oils in modern life; (2) Favela or Faveleira (*Jatropha* spp.) oil, its characteristics and industrial (and other) possibilities; and (3) the climatic, social and economic problems of the semi-arid region of north-eastern Brazil in which the plant is found. The Favelá is a drought-resistant species thriving on poor, dry, stony soils.

[601]. 34.26 : 12.26–8 : 12.11.1. Cattaneo, P. Composición química del aceite de semillas de *Erytrina cristagalli*. [**Chemical composition of the seed oil of *Erythrina cristagalli*.**] *An. Asoc. quím. argent.* 33 (170), 1945 (5–16). [Span.span.] [Facultad de Ciencias Exactas, Físicas y Naturales, Buenos Aires.] L.S.

[602]. 34.26 : 12.26–8. Báez, M. La parapara. [***Sapindus saponaria*, Soapberry tree.**] *Agric. venez.* 8 (95/96), 1944 (33–4). [Span.] A.P.B.

Cultivation, uses, economic importance, preparation of saponin and the edible oil.

[603]. 34.26 : 12.29 (81). Small, W. N. **Brazil's 'Tree of Life' greatest source of wax.** *Amer. Paint J.* 27 (2; 4), 1942 (18–9, 21–2; 18, 20, 22–3, 26). [U.S. Department of Commerce, Washington, D.C.] L.S.

The palm Carnauba (*Copernicia cerifera*) exudes wax from the leaves and petioles during the dry season to counteract loss of moisture. Although it flourishes in Ceylon and French Equatorial Africa, it is not commercially important outside the semi-arid, north-eastern area of Brazil where it is indigenous. The sap, leaves and timber of Carnauba are all utilized locally and the wax has varied uses in the United States.

Information is given on methods of harvesting and drying Carnauba leaves, extraction of the wax, and the export trade. Each cutting yields 8 to 12 leaves per tree, and from each leaf 4 to 7 g. of wax are obtained. Normally trees yield wax 7 years after planting, but full production is not reached until the tenth year. Cuttings should be at least 60 days apart, and more than two or three cuttings per annum are not recommended if a steady yield is to be maintained.

At least 80 per cent. of the wax produced is exported, chiefly to the United States and Great Britain, most of the remainder going to Southern Brazil.

[604]. 34.26. Nightingale, W. H. **Production of petrol and oil substitutes from rubber.** *Chem. & Ind.* 38 (1), 1946 (9). P.R.

A description of a makeshift plant evolved by the Japanese in Burma during the Occupation for producing oils from natural rubber. The essentials are a large drum and a system of condensation. Wood was used as the source of heat. 100–125 lb. of dried cured rubber produced approximately 6 gallons petrol, 2 gallons kerosene, 1 gallon of light oil and 1 quart of engine oil. The method is not new, having been previously investigated and discarded as uneconomic. Products were of poor quality.

[605]. 34.26 (79.1 : 79.4). Buehrer, T. F., and Benson, L. **Rubber content of native plants of the southwestern desert.** *Tech. Bull. Ariz. agric. Exp. Sta.* No. 108, 1945. pp. 33.

Includes a table showing the rubber content of plants of 93 genera growing either in their native habitat or under irrigation in the southwestern desert of Arizona. The great majority of the 183 individual samples examined showed a rubber content far below that required for commercial purposes. Among the species containing over 2 per cent. of rubber were *Garrya wrightii* and *Tecoma stans* var. *angustatum.*

[606]. 34.26 : 12.11.11. Hendricks, S. B. Wildman, S. G., and Jones, E. J. **Differentiation of rubber and gutta hydrocarbons in plant materials.** *Arch. Biochem.* 7 (3), 1945 (427–38). M.R.C.L.

Hydrocarbons of the rubber (*r*) or gutta (*g*) types isolated from *Hevea brasiliensis* (*r*), *Mimusops balata* (*g*), *Asclepias erosa* (*r*), *A. syriaca* (*r*), *Oenothera biennis* (*r*), *Solidago leavenworthii* (*r*), *Eucommia ulmoides* (*g*) *Euonymus japonicus* (*g*), and *Jatropha* sp. (*r*) were positively identified by their light absorptions near 12μ. Mixed *cis-* and *trans-* isomers were absent in all cases even though the plants examined were selected as giving hydrocarbon polymers of questionable types. *Authors' summary.*

[607]. 34.26 : 12.26–8. White, D. G. **An electrometric method for defining the area of bark affected by tapping *Hevea brasiliensis.*** *Plant Physiol.* 21 (1), 1946 (102–8). [Federal Exp. Sta., Mayaguez, Puerto Rico.] O.B.D.

[608]. 34.26 : 12.26–8 (7) : 2 : 35 : 4. Dansereau, P. Les conditions de l'acériculture. **[The conditions of Maple cultivation.]** *Bull. Serv. Biogeogr., Montreal* No. 1, 1945. pp. 52. [F.] *Repr.* from *Agriculture* 2, 1945 (45–57, 140–52, 259–67, 332–48).

An illustrated general review of the subject, including ecology, physiology, silviculture, protection, and exploitation. Subjects for future research are summarized and there is a very full bibliography of over 300 references. [Cf. *For. Abstr.* 8 (No. 79, 548).]

[609]. 34.26 (71.4) : 12.26–8. Dansereau, P. L'industrie de l'Érable. **[The Sugar Maple industry.]** Service de biogéographie, Institut de biologie, Univ. of Montreal. 1944. pp. 43. [F.]

A review of the present state of knowledge of the ecology, conservation and exploitation of the Sugar Maple in Quebec. Suggestions are made for subjects of research. Tabular data on yield, production (over the past century), and export of sugar and syrup; bibliography of 9 pages.

[610]. 34.26 : 12.26–8 (71.4). Guimont, A. Avec l'érable, il faut être prudent. **[Care is necessary with the Maple.]** *For. québec.* 11 (4), 1946 (259–60). [F.]

A study made in Quebec in the springs of 1943–44 showed that the quantity of sap obtained from a Maple increased with the number of incisions up to 3 but not beyond that number. Further research is needed to establish what number and width of incisions can be made to produce the greatest yield without injuring the health of the tree.

34.28. Osiers. Bamboos

[611]. 34.28 : 12.26–8 (489) : 32.25.5. Hansen, H. R. Meddelelse til Dansk Piledyrkerforenings Medlemmer. **[Report to the members of the Danish Osier-growers' Association.]** *Dansk Skovforen. Tidsskr.* 25 (5), 1940 (221–8). [Dan.]

Includes a sequence of 8 photographs showing the method of barking and of drying the barked rods.

[612]. 34.28 : 12.26–8 : 76 (489) : 45.3 : 13.2. Hansen, H. R. Meddelelser fra Dansk Piledyrkerforening. **[Reports from the Danish Osier-growers' Association.]** *Dansk*

Skovforen. Tidsskr. 29 (4), 1944 (160–5). [Dan.]

Containing: (i) Figures for (war-time) costs and returns for an Osier plantation of 1·2 ha. (ii) Brief notes on the life history of the leaf-beetle *Phyllodecta vulgatissima* and its control: (*a*) by burning with straw in late May, a treatment tried in Germany which gave complete control and, though killing the new shoots, then about 1 cm. long, did not appear to cause a serious setback to the growth of the Osiers; (*b*) with derris powder at about 10 kg. per ha., applied several times in spring, which in Denmark gave a beetle mortality of 90–100 per cent., (*c*) with a spray made up by dissolving 0.5 kg. of NaF and 2 kg. of sugar in 10 l. water and subsequently making up to 100 l. with water; this gave about 100 per cent. mortality in a German trial in late July, but spring treatment, several times repeated, would be easier to carry out. Derris and NaF being unavailable in Denmark at the time of writing, trials with 'Cryocid powder, 80 per cent.', applied several times in spring at rates of 15–20 kg. per ha., were recommended. Tests of Gesarol [cf. *For. Abstr.* 7 (No. 1418)], were also envisaged.

[613]. 34.28 : 12.26–8 (489) : 2. HANSEN, H. R. Dyrkning af Baandpil. **[Osier-growing.]** *Dansk Skovforen. Tidsskr.* 26 (3), 1941 (129–47). [Dan.]

A lecture describing in considerable detail the cultivation of *Salix viminalis*, with notes on choice and preparation of the land, drainage, liming and fertilizing, preparation and planting of cuttings, treatment of the plantation, pests and diseases, harvesting and yield, possible by-products, and the history of Osier-growing in Denmark. In peace-time the annual consumption of rods for hoops on butter casks was about 1,800 metric tons, chiefly imported. To supply this important market, which is expected to revive when normal conditions return, entirely with Danish-grown material, would require an area of between 1,200 and 1,600 ha. under Osiers grown on a 2-year coppice rotation, as only 2-year-old rods are suitable for the purpose mentioned.

[614]. 34.28 : 12.26–8 (82). CORNELL, C. El cultivo del mimbre en las islas del Delta del Paraná. **[The cultivation of Willow on the islands of the Paraná Delta.]** *Alm. Minist. Agric. Argentina* 19, 1944 (225–7). [Span.] A.P.B.

[615]. 34.28 : 12.25 : 33.8. **Wood good substitute for bamboo poles.** *W. Cst. Lumberm.* 72 (10), 1945 (86).

Test data for round rods of Douglas Fir, Hemlock or Pine $1\frac{5}{16}$ or $1\frac{3}{8}$ in. in diameter which show they can be used as substitutes for Bamboo fishing rods and are as strong as the standard Bamboo rod of $1\frac{3}{8}$ in.

[616]. 34.28 : 12.29 : 2 (7 : 8). MCCLURE, F. A. **Bamboo culture in the Americas.** *Agric. in Americas* 5 (1), 1945 (3–7, 15–6). A.P.B.

The useful Bamboos of the Western Hemisphere belong mainly to the tropical genera *Guadua* and *Merostachys.* In the early part of the present century trial plantings of various exotic Bamboos were made in the United States, mainly for ornamental purposes, but only exceptionally were efforts made at rational control and utilization. In the present paper, advice is given on the selection of Bamboos for economic cultivation; propagation by seed; vegetative propagation; and the general soil and moisture requirements of Bamboos.

[617]. 34.28 : 12.29 (86). MCCLURE, F. A. **Bamboo in Ecuador's lowlands.** *Agric. in Americas* 5 (10), 1945 (190–2, 194). A.P.B.

The Bamboo *Guadua angustifolia* occurs in two strains *Caña mansa* and the more durable *Caña brava,* distributed about equally through the Ecuadorean lowlands. Its primary value is for floors, walls, partitions, rafters and sheathing but it is also used for furniture, fish traps, sunning floors, and cacao-harvesting poles; in the dry season it is a source of drinking water. Trial plantings have been made at the Agricultural Experiment Station of Ecuador at Pichilingue to test the adaptability of species of Bamboo from China, Japan, India and Java, selected for superior quality and technical versatility of their culms and resistance to borers.

35. SALE AND DISPOSAL OF FOREST PRODUCTS. TIMBER TRADE

[618]. 35 (410) : 09.4. WATSON, SIR H. **Imports of timber into the United Kingdom, 1939–44.** *Emp. For. J.* 24 (2), 1945 (201–4).

The figures are taken from preliminary accounts published by the Board of Trade, and exclude timber imported for military stores; they are given both on a basis of different categories of wood and sources of supply.

[619]. 35 (485). Läget på trävarumarknaden. **[The situation on the market for timber goods.]** *Skogen* 33 (7), 1946 (109–10). [Sw.]

In 1945 Sweden's exports of sawn and planed timber goods, including box shooks and small timber were as follows:—

Destination	1945, *stds.*	*Average of* 1935–9, *stds.*
Great Britain	328,488	380,944
Denmark	84,988	85,091
Holland	73,888	63,809
France	19,997	35,522
Norway	18,690	27,682
Belgium	18,332	26,145
Spain	593	17,780
Germany	—	66,536
Other European countries	9,083	21,208
Union of S. Africa	6,290	20,294
Australia	—	2,337
South America	2,615	1,237
Other non-European countries	12,663	30,077
Total	575,627	778,662

The exports to Denmark, Holland and Norway were made under agreements whereby Sweden has granted reconstruction credits to those countries. Imports from the United Kingdom fell a great deal short of Swedish exports and Sweden has thus accumulated considerable sterling credits. Extra-European trade was hampered by difficulties in obtaining payment, either in wares or money. Exports of goods such as planed products and box shooks were much lower than before the war, owing largely to the growth of woodworking industries in the importing countries during the war, a fact which will cause difficulties if this market is to be won back for Swedish goods. Domestic consumption of timber goods in Sweden in 1945 was about 650,000 std., or some 10,000 more than in 1944. Maximum prices for such timber, fixed in 1942, have become much lower than export prices and in June 1945 price-equalization dues of about 40 Kr. per std. (about 10 per cent. of the average export price) were imposed on timber products for export. It is now felt that this combination of circumstances is a hindrance to production. Permits for export sales in 1946 are held up pending the establishment of commercial agreements with foreign governments, but the quantity of sawn and planed goods available for export during the year has been fixed at 400,000 stds. The previous year's exports were possible owing to the existence of reserve stocks, but the reserve of timber goods at the mills is now the lowest for 70 years. Domestic consumption is expected to be about 600,000 stds., and timber will be in short supply.

[620]. 35 (485). Prisutjämningsavgifterna. **[The price-equalization dues.]** *Skogen* 33 (9), 1946 (145–6). [Sw.]

The funds accumulated from price-equalization dues in Sweden [cf. preceding abstract] between 8th June 1945 and 1st March 1946, amount to 16·6 million Kr. and are expected to reach 20 million by 1st July, 1946. Several bodies have put forward proposals on the use of this money, including the Norrland Committee, which has urged that in the present budget year 10 million Kr. should be used for research purposes, 4 million for social purposes, and the remainder for the rehabilitation of the forests. The Ministry concerned agrees in the main with this proposal, itself proposing that 11 million Kr. should go to research and 5 million for social purposes. As large sums are expected to accrue from this source in the coming year, a more detailed plan for their disposal is expected to be made later.

[621]. 35 (489). Møller, C. M. Fremtidsudsigterne for vort Naaletræmarked. **[Future prospects of the market for coniferous wood in Denmark.]** *Dansk Skovforen. Tidsskr.* 26 (6), 1941 (221–34). [Dan.] Lund-Christjansen, S. Fremtidens Naaletræmarked. **[The future market for coniferous wood.]** *Dansk Skovforen. Tidsskr.* 26 (7), 1941 (255–8). [Dan.]

From an examination of the probable increment of Danish conifers, predominantly Spruce, in relation to probable trends in consumption, it is concluded that in a few decades Denmark will be confronted with a choice between (*a*) exporting some of her Spruce in the round and at lower prices than those recently obtained in the Danish market, and (*b*) developing new domestic markets, e.g. pulp and other chemical industries, which under conditions of free international trade would also be likely to pay lower prices. Thus the economic superiority of Spruce as compared with Beech and Oak will probably decrease somewhat. If the main advantage of Spruce—its straight form—should become less important, prices would be increasingly influenced by the density of the wood (an important factor in various chemical uses of wood), and this also would depress Spruce prices as compared with those for hardwoods. [Cf. *For. Abstr.* 8 (Nos. 163, 778).]

Lund-Christjansen agrees in general with Møller's conclusions and adds that a possible decrease in population would aggravate the problem. He advocates the planting of species of wider utility and higher wood quality than Norway Spruce, e.g. Larch, Douglas, *Thuja*, *Chamaecyparis*, *Tsuga*, and possibly hardwoods such as Tulip Tree, Sugar Maple, Small-leaved Lime, Red Oak.

[622]. 35 (489) : 7 : 90. Hviid, A. De økonomiske Fremtidsudsigter for dansk Skovbrug. **[The economic prospects of Danish forestry.** (With discussion.)] *Dansk Skovforen. Tidsskr.* 31 (3), 1946 (95–123). [Dan.]

A lecture and discussion, with the conclusion that although in the first part of the war economic conditions were highly favourable to Danish forestry, low maximum prices for wood and high labour costs have brought about a situation in which economic conditions must be improved if the productive capacity of the forests is to be restored for the benefit of those engaged in forestry and the community at large. The best means of improvement lies in the raising of prices for forest products to an equitable level, and it is considered that Danish forestry is now in a good position to claim that increased prices should be determined by the price control authority.

[623]. 35 (6) : 33 : 34. Aartsen, J. P. van. **Products of African woodlands.** *Repr.* from *Int. Rev. Agric.* 34 (11/12), 1943 (421T–41T).

The writer reviews the forest production of Africa, giving detailed attention to a few products, and concludes that the value of the African forests lies, to a considerable extent, in the so-called minor products, but that their export is much less profitable to the people than it could be. Further progress in standardization of the products to be exported should be aimed at, and it is suggested that export duties to be levied should be considerably higher for inferior articles than for those which fulfil the required standards.

[624]. 35 (67.1 : 67.2). Gazonnaud, P. La vente des bois coloniaux français aux États-Unis. **[The sale of French colonial woods to the United States.]** *Rev. int. Prod. colon.* 21 (198), 1946 (33–6). [F.]

It is concluded, from a rapid survey, that the possibilities of a market for tropical colonial woods in the United States are not very great and are more or less limited to woods suitable for veneer cutting, notably *Khaya ivorensis*, and plywood manufacture, notably Okoumé (*Aucoumea klaineana*), and then only on condition of their being of low price and standard quality.

[625]. 35 (73) : 05.4. **Official yearbook: forty-eighth annual convention, 1945.** National Hardwood Lumber Association, Chicago. 1945. pp. 171. P.R.

[626]. 35 (73) : 9. United States. **Forests and employment. Report of the Chief of the Forest Service [1944–] 1945.** U.S. Forest Service, Washington, D.C. 1946. pp. iii + 35.

During the war, lumber consumption in the United States consistently outstripped sawmill production, which made it necessary to draw heavily on stocks. Total lumber stocks at the end of 1941 were about 17 billion bd. ft., but by the end of 1944 were only 6 billion bd ft. Total domestic needs during the first post-war decade are expected to average about 13·8 billion cu. ft. annually. To this must be added perhaps 2 billion cu. ft. of losses from fire, insects and disease. Looking several decades ahead, and making allowance for new uses and exports as well as losses, the aim should be an annual timber crop of over 20 billion cu. ft. This compares with estimated annual growth in 1938 of only 11·3 billion cu. ft. The deficit is aggravated by the fact that much of the present forest growth is not in timber of the size, species, and grade demanded by users. Prospective long-term requirements for forest products can be met only through prompt action to bring about more complete utilization of the timber cut, better protection of forests from fire and overcutting, and forestry practices that will build up growing stock (pp. 10–11).

[627]. 35 (81 : 82) : 12.25. O pinho brasileiro no mercado argentino. **[The Brazilian Pine in Argentine trade.]** *Brasil madeireiro* 1 (5), 1945 (28–9). [Port.]

Argentine imports of Brazilian Pine rose from 4,974,131 sq. m. in 1926 to 15,843,774 sq. m. in 1944. These figures represent 17·1 and 94·6 per cent., respectively, of the total Argentine imports of Pine timber.

[628]. 35 (81) : 90. PEREIRA BRASIL, R. Madeiras da Amazonia. **[Timbers of Amazonia.]** *Brasil madeireiro* 1 (4), 1945 (12–5). [Port.] *Repr.* from *Digesto econômico.*

A general review of the forest situation in Brazilian Amazonia (particularly Pará) with special reference to the commercial and economic future of the area. Stress is laid on the need for rational exploitation. The laminated wood industry is expected to play a large part in the expansion of Brazilian trade.

[629]. 35 (88) : 33 : 34.26. Evolution et possibilités de la production forestière de la Guyane. **[Development and future possibilities of forest production in Guiana.]** *Rev. int. Prod. colon.* No. 196–7, 1946 (1–3). [F.] [Also in *Rev. int. Bois* 13 (104), 1946 (41–3).]

Exports of wood from French Guiana increased between 1935 and 1938 from 308 to 1,577 tons. During the war almost all exports went to Guadeloupe and Martinique. Logging is done by native labour and mainly by manual work and the 4 modern sawmills have only a small capacity. Some account is given of the process of distilling oil of Rosewood [*Dalbergia* sp.]. One ton of wood produces 8–15 kg. of oil, the linalol content of which varies from 70 to 96 per cent. The collection of balata gum ceased during the war. The need for mechanizing the logging industry is urged, and it is recommended that soft, light woods should be used for rafting the heavier woods, and finally utilized when they reach the sawmills. It is desirable that care should be given to the regeneration, and if necessary, the planting, of Rosewood.

[630]. 35 (89) : 34. PETERSON, L. E. Productos forestales del Paraguay. **[Forest products of Paraguay.]** *Rev. Cent. Estud. Cienc. econ., Asunción* No. 66, 1945 (663–733). [Span.span.] [Servicio Técnico Interamericano de Cooperación Agrícola.] P.R.

A review of the production, local consumption and export of forest products in Paraguay, including logs, sleepers, poles, firewood, sawtimber, plywood, wooden containers, furniture, charcoal, Quebracho extract, tannin, maté, essential oils, medicinal plant products, baskets, brooms and artistic objects made of wood, and Mangava (?*Hancornia speciosa*) rubber. The most important exports in 1943 were tannin extracts, logs, essential oils, and maté, while the products of greatest importance in the home market were firewood, sawtimber, charcoal, maté, and wooden boxes. The demand for and rising costs of firewood and charcoal in Paraguay, suggest the need for reforestation in the central zone. In Paraguay, there is no silviculture and no reforestation worthy of mention. Immediate prospects of new forest industries are not bright. The sawtimber industry is undeveloped; the Quebracho extract industry is threatened by decrease in Quebracho supplies, exchange difficulties, transport, and lack of labour; and the maté industry depends on an already overstocked market (Argentina). For reforestation, Eucalyptus, Paraná Pine, Pines from the southern United States, and hybrid Poplars are advocated.

Data are given on the production, consumption and export of wood products in Paraguay in recent years, with lists of timbers suitable for specific uses.

[631]. 35 (94) : 9. **Tariff board inquiry into timber duties.** *Aust. Timb. J.* 11 (9; 10; 11), 1945 (409, 411, 414, 421–37, 462–512, 533–79).

Evidence given at the Tariff Board Inquiries at Sydney and Melbourne in October 1945, concerning the proposed temporary lifting of the tariff upon timber imports into Australia, is published in full. Representatives of the South Australian and the Sydney and Suburban Timber Merchants' Associations advocated the lifting of the tariff on the grounds that native timber industries would be unable to meet post-war demands in Australia. Representatives of the New South Wales Forestry

Commission, the Queensland Forest Service, the Tasmanian Timber Association and other witnesses opposed the deferment of the tariff because of the resulting adverse effect on native timber production. They maintained that native timbers, formerly regarded as of low quality and unable to compete with imported timber, had been utilized and found valuable during the war. They believed that Australia's potential timber production was greatly underestimated, and that with a stable market, native producers could meet Australia's post-war demands.

38. FOREST CONSTRUCTIONAL WORKS. ENGINEERING

[632]. 38 : 07.1. HANRAHAN, F. J. **Teaching timber engineering.** *B.C. Lumberm.* 30 (1), 1946 (73–4).

The writer complains that many practising structural engineers and teachers of engineering are ignorant of the engineering properties of wood, and urges the necessity for finding a place for timber construction in the curricula of engineering schools.

[633]. 38 : 07.7. KELLEY, J. J. **Fastening and reinforcement of timber.** *Proc. Amer. Wood-Pres. Ass.* 41, 1945 (228–30).

The Giant-Grip drive dowel is a spirally twisted steel pin which can be used to dissipate and neutralize the splitting forces in timber constructions. It has been used with success as an anti-splitting device for railway sleepers. By the correct application of dowels, the cross arms of pole lines can be reinforced where the loosening of the insulator bolt tends to cause splitting. The dowel also has advantages over bolts and nuts, long screws and common spikes, because of its greater pitch and depth of thread, and because the fact that it grips the timber over its entire length precludes the necessity for a head. It has been used successfully to secure laminated pieces together, to fasten spliced piles for the purpose of obtaining greater lengths, to fasten caps to piles in dock construction and to bond short subway sleepers to their concrete base.

38.2. *Building Construction. Foundations and Superstructures*

[634]. 38.2. WILSON, G. **Some aspects of the scientific use of timber in building.** *Off. Archit.* 9 (2), 1946 (78–80). P.R.

Some suggestions are made for new types of roof construction with plans and specifications. The development of the ring connector is discussed, and a figure shows an example of a 64-ft.-span Belfast truss with a glued laminated top boom.

[635]. 38.2. HANRAHAN, F. J. **Structural stability under hurricane forces.** *B.C. Lumberm.* 30 (2), 1946 (65–6, 70–1).

A report on the collapse of three wooden naval airship hangars during a 175 m.p.h. gale in Florida. It was found that the cause of the failure was a wind load exceeding 2½ times that for which the structures were designed. The hangars were each about 300 ft. wide, 1,060 ft. long and more than 180 ft. high, with no interior partitions. Though untreated interior portions of the wood members were often exposed to breakage by falling from great heights, the fire-retardant treatment of the wood prevented or assisted in preventing fire and spread of fire where it was not fed directly by the highly combustible contents of the building, such as high octane spirit. No evidence of failure of timber connectors or bolts was found.

[636]. 38.2 : 31.27. SCHOLTEN, J. A. **Timber-connector joints: their strength and design.** *Tech. Bull. U.S. Dep. Agric.* No. 865, 1944. pp. 106.

Three widely used types of connectors, representing three distinct methods of application, were selected for intensive study. They were the split-ring, toothed-ring, and claw-plate connectors. The principal purpose of this bulletin is to present current design data for the three types in various sizes, when used with different species of wood, and to provide an analysis of the various factors which affect the strength of connector joints.

[637]. 38.2 : 31.27. SCHOLTEN, J. A. **Strength of bolted timber joints.** *Rep. U. S. For. Prod. Lab., Madison.* No. *R*1202 (revised), 1946. pp. 2 + tbls. + fig. P.R.

[See *For. Abstr.* 1 (275).] The revised edition contains a chart for determining the bearing strength of wood at various angles to the grain.

[638]. 38.2 : 31.4 : 33.36 (71.1). Eades, H. W. **Cause and prevention of decay in wooden buildings, with particular reference to coastal B.C.** *B.C. Lumberm.* 29 (12), 1945 (28–9, 92, 94, 96–8).

The damp climate of the coastal region of British Columbia and Vancouver is especially conducive to decay, and it is often not recognized that methods of timber construction which may be suitable in other parts of Canada are not suitable to this region. This bulletin describes a few simple precautions in selection and proofing of timber, drainage and ventilation, which would materially reduce losses from decay.

[639]. 38.2 : 31.4 : 33.36 (71.1). Eades, H. W. **Cause and prevention of decay in wooden buildings, with particular reference to the coastal region of British Columbia.** *Circ. Dom. For. Serv.* No. 61, 1945. pp. 12.

[640]. 38.2 : 33.15.3. Ladon, A. A. (to Masonite Corp.). **Thin building board roofs for storage bins, playhouses and the like.** *U.S. Patent* No. 2,356,768, Aug. 29, 1944. Chem. Abstr. 29, 1945 (171). P.R.

Roofs are formed of a relatively thin single sheet of building board such as 'Presdwood' or 'Asbestos Wood' so stressed that it forms substantially a right circular cone of self-supporting and load-supporting character.

[641]. 38.3 (728) : 31.2. Scholten, J. A. **Structural timber for bridge construction in Central America.** *Repr.* from *Proc. Highw. Res. Bd., Wash.* 24, 1944 (202–6). P.R.

An account of enquiries made under the auspices of the Latin American Resources Project into the suitability of Central American timbers for bridge-building, etc., and in particular for structures to be built in Costa Rica by the Pan-American Highway. Large mixed stands, mainly hardwoods, exist in Central America, but data on the strength and other properties of the wood are lacking. Local practice gives some indication of the properties of a timber and some estimation of its strength can be made by a comparison of specific gravities. A table is published giving the specific gravities and modulus of rupture when green of twenty-five South American Woods. Native woods used in bridge-building by the Pan-American highway included Nispero, Mora, Guayacan, Zapatero, Laurel, Maria and Ira Chinicana. Because of transport difficulties from mixed stands, use for structural purposes will be confined to localities near the forest and to woods with the best-known properties.

[642]. 38.2 : 82 (485). Wallner, O. Monteringsfärdiga härbärgen för skogsarbetare samt skogsstall. **[Prefabricated cabins for forest workers and prefabricated forest stables.]** *Svenska SkogsvFören. Tidskr.* 42 (3), 1944 (237–45). [Sw.]

38.3. *Road and Bridge Construction*

[643]. 38.3 : 38.5. Youhotsky, M. J. **Road embankment as dams in hilly country.** *Aust. Timb. J.* 11 (12), 1945–46 (605, 626).

In amplification of a previous article [see *For. Abstr.* 4 (188)] the writer suggests a scheme for impounding water by a road dam in cases where it is necessary to cross two gullies in close succession. A cutting through the intervening spur will provide a relief channel from the dammed to the undammed gully, to take off flood waters, which are the main obstacle to the use of such dams for water storage.

[644]. 38.3 (485) : 96.4 : 95.2 : 07.7. Staël von Holstein, J. Statsbidrag och maskinella hjälpmedel vid skogsvägbyggen. **[State subsidies for and mechanical aids to road-building.]** *Svenska SkogsvFören. Tidskr.* 42 (5), 1944 (377–90). [Sw.]

Swedish laws relating to State subsidies and loans for the building and maintenance of private and forest roads are discussed for the guidance of forest owners, and brief notes are appended on the use of bulldozers, pneumatic drills, crushing and sorting machines for road metal, and levelling equipment.

38.6. *Drainage*

[645]. 38.62 (485) : 11.49.5. Jungstedt, B. Torvmarksinventeringen på domänskogar i södra Sverige. **[Inventory of peatland in**

the state forest lands of southern Sweden.] *Svenska SkogsvFören. Tidskr.* 42 (4), 1944 (259–81). [Sw.]

The peatlands worth draining in S. Sweden are the better wooded peats (usually of a fen type), unwooded fen, the better sedge mosses, wooded bogs and the better of those with a vegetation of dwarf shrubs, the last-named having proved to give unexpectedly good results after drainage. For the region in question (state forest land S. of lat. 61° N.) the recent inventory has given the following figures:—

Total 'primary' peatland . . .	103,700 ha.
Present drained area	38,000 ,,
Drained but not worth maintaining .	2,800 ,,
In need of supplementary work .	12,200 ,,
Suitable for draining	33,300 ,,
Total that should be drained . .	45,500 ,,
Land unsuitable for drainage . .	32,400 ,,

Notes are included on drainage methods in relation to precipitation, cleaning and supplementary work, bank gradients, and elk damage to young growth on drained land. Great importance is attached to the use of peripheral drains, which in many places where precipitation is high are essential for proper drainage, are cheapest, and will often serve efficiently as main drains. [Cf. *For. Abstr.* 8 (No. 255).]

38.8. *Torrent Training*

[646]. 38.8 (44) : 23.3. GUISLAIN, A. Les heureux effets d'un reboisement: correction du 'Pontis' à Barèges: **[The good effects of afforestation: torrent training on the Pontis at Barèges.]** *Rev. Eaux For.* 84 (2), 1946 (75–8). [F.]

An illustrated account of the successful control of a destructive torrent in the Pyrenees by afforestation of the precipitous catchment basin, in the space of 40 years.

4. FOREST INJURIES AND PROTECTION

[647]. 4 : 12.26–8 (66.9). NIGERIA. **Annual report on the forest administration of Nigeria for the period 1st January 1944 to 31st March 1945.** Govt. Printer, Lagos. 1945. pp. 47.

An unusual die-back of Neem (*Azadirachta indica*) was noted in the Sokoto plantations late in the dry season of 1943–44. Some fungal attack was suspected, but the trouble disappeared after a thinning had been made (p. 10).

[648]. 4 : 12.26–8 (79). MILLER, H. W. **A new disease of Russian Olive in the Pacific Northwest.** *J. For.* 44 (2), 1946 (118–20). [Nursery Division, Soil Conservation Service, Pullman, Wash.]

Russian Olive (*Elaeagnus angustifolia*) has been attacked in Washington, Idaho and Oregon by a previously unreported disease. The first symptom is the arrested development of the buds, which remain partially opened and gradually dry up. In the following year the affected part of the branch is dead. The arrested development of buds progresses down the stem until the root collar is reached and the plant is entirely killed. Preliminary investigations have failed to reveal the causes of the disease. Co-operative investigations are continuing. There is no record of the occurrence of the disease in irrigated plantings. *From author's summary.*

41. GENERAL PROTECTION AGAINST FOREST INJURIES

[649]. 41 (69) : 31.43 : 33.36.1. MOUTIA, L. A., and MAMET, R. **A review of twenty-five years of economic entomology in the Island of Mauritius.** *Bull. ent. Res.* 36 (4), 1946 (439–72 + plates).

The practical results achieved in the past 25 years' work on the major insect pests of Mauritius are discussed. An historical review is given of the introduction of the cochineal insects of the Prickly Pear, *Dactylopius indicus* and *D. tomentosus*, which have completely eradicated *Opuntia tuna* and *O. monacantha*. A review of the species of termites found in Mauritius and their control is given; an insecticidal powder containing arsenious oxide has given good results.

During the last 25–30 years, 64 species of parasites and predators have been imported for the biological control of 8 species of insects of major economic importance and 2 noxious plants. The results indicate that introduction of parasites and predators into insular countries should be carried out only after a thorough investigation of the various ecological, biotic and climatic factors in the countries of origin and importation. *From authors' summary.*

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

42.1. *Air Currents*

See also *For. Abstr.* 8 (No. 657).

[650]. 42.1 (66.9) : 12.26–8. NIGERIA. **Annual report on the forest administration of Nigeria for the period 1st January 1944 to 31st March 1945.** Govt. Printer, Lagos. 1945. pp. 47.

In the Ibadan plantations a root rot of *Cassia siamea* forms after the second or third exploitation and causes the coppicing stools to be windthrown. The damage is not yet extensive, but its increasing spread (it also occurs on the Gold Coast) is causing some anxiety. The Teak plantations at Olokemeji suffered severely from windthrow, probably as a result of overthinning in earlier years. As the blanks are formed, the process appears to be cumulative, and such effects should serve to emphasize the caution necessary in thinning Teak (p. 10).

[651]. 42.1 (69) : 38.2 : 33.53. KING, H. C. **Notes on the three cyclones in Mauritius in 1945: their effect on exotic plantations, indigenous forest and on some timber buildings.** *Emp. For. J.* 24 (2), 1945 (192–5).

At the time when the cyclones occurred, a working plan to cover all aspects of the Pine plantations scheme had recently been finished. It was suggested in the working plan that, given an ample system of roads for speedy removal of broken material, the probability of recurring cyclones is not sufficient to discredit the forecasts made in the scheme. This plan will now have to be drastically revised. Young plantations, 1939–43, suffered about 30–60 per cent. loss from plants broken or blown over. 1928–38 plantations of *Pinus taeda* and *P. caribaea* were virtually destroyed. Of the older woods, 1904–22, which had survived the heavy fellings during the war, only about 10 per cent. remain standing. The dominant *P. sinensis* suffered most. The provision of shelterbelts of more resistant species is not now considered an effective defence.

The indigenous flora, characterized by slow growth and hard timber, is well adapted to resist high winds. Crowns are mainly low and umbrella-shaped, roots are buttressed, and leaves are small and coriaceous. The wholesale stripping of foliage from exotic species did not extend to indigenous species on sheltered sites, and the few trees lost in the main reserves were chiefly poles 6–11 in. d.b.h. There is a local tradition that Bois de Rivière (*Homalium paniculatum*) will only flower profusely after a cyclone, and this was confirmed in February and March following the cyclone in January. Flowering seems to be stimulated by partial defoliation.

Timber is still the chief building material. The effect of the 3 cyclones on wooden houses of very varied size and style, seems to show that, if design, construction and maintenance are properly carried out, cyclone damage is eliminated. Wooden transmission poles, mainly *Eucalyptus tereticornis*, proved more resistant than metal ones; in particular, a 22 K.V.A. line, carried by *Eucalyptus* poles 32 ft. long, right across the island, suffered no damage.

42.2. *Temperature Influences*

See also *For. Abstr.* 8 (No. 309).

[652]. 42.21 : 12.25 : 44.3 (410). DAY, W. R. **A discussion of causes of dying-back of Corsican Pine, with special reference to frost injury.** *Forestry* 19, 1945 (4–26). [Department of Forestry, Univ. of Oxford.]

The studies reported on show that frost injury, which occurs principally in the autumn, is responsible for a serious dying-back of the crown of Corsican Pine (*Pinus laricio* var. *corsicana*). This disease is widely distributed over the west and north of England and Wales and it is clear that great care must be taken in the use of Corsican Pine in many parts of England and Wales, the more upland regions being particularly dangerous. The south-east quarter of England has so far been free from any but locally serious injury. This may be related to an earlier cessation of growth correlated with the higher summer temperatures typical of this part of Britain. The general conclusion is that, especially in the west and north, Corsican Pine should be confined to topographical situations which do not favour the occurrence of severe low temperatures, and to the lower elevations. [See also *For. Abstr.* 8 (No. 167).] *From author's summary.*

[653]. 42.21 : 21.12 (485). NILSSON, A. Vedartade växters förmåga att uthärda stränga vintrar. **[The ability of woody species to withstand severe winters.]** *Agri. Hort. Genet., Landskrona* 1 (3/4), 1943 (99–136). [Sw.g.e.] C.G.B.

A report on the cold resistance of woody species (chiefly of horticultural species; wild individuals excluded) in the vicinity of Landskrona, Skåne, for the unusually severe winters of 1939–42. Notes on damage to the individual species are listed alphabetically by genera and species, the damage being classified in 5 degrees of severity.

[654]. 42.22 (73) : 12.19 : 11.11.4. ALBERTSON, F. W., and WEAVER, J. E. **Injury and death or recovery of trees in prairie climate.** *Ecol. Monogr.* 15 (4), 1945 (393–433).

This study describes the effects of the greatest drought since meteorological records were kept, on forests and trees growing in a prairie climate. The area considered extends from Iowa to Colorado and from Oklahoma to Canada. Data are drawn from a wide range of sources; they include pre-drought surveys of trees and conditions for their growth in grassland, which give a necessary background for an understanding of their injury and death or recovery in different sites. The chief cause of injury was lack of sufficient available water, due to low precipitation and accentuated by one or more of several causes, such as competition for water by grasses, decreased rate of infiltration, and rapid run-off, drying up of streams and springs, and a rapid fall of the water table in ravines and lowland terraces. Other factors were low humidity, high evaporation, desiccating winds, and the inability of trees to accommodate their root systems to the rapidly changing environment. Unrestricted grazing was a common cause of excessive mortality in plantations and windbreaks.

Experimental data on the harmful effects of competition with grass on both roots and shoots of trees are presented. Root distribution of the same tree species in different types of soil, including alluvial soil with a high water table, has been noted and the general relation between extent and distribution of roots in different sites and drought resistance is pointed out.

Injury and death of woody plants from the effects of drought were often the results of continuous adverse conditions over a long period, but death of trees and shrubs on flood plains and terraces sometimes occurred in a relatively short time if the water table was lowered rapidly. Effects of early drought were wilting, discoloration, withering, or shedding of foliage. An early outward sign of repeated yearly drought among deciduous trees was great reduction in size and number of leaves and defoliation of the outer portions of the crown. Great injury was also often caused by partial or total and sometimes repeated defoliation by grasshoppers, webworms, and leaf-eating larvae of other insects; such attacks usually occurred during years of great drought. Exposure of branches with reduced foliage to high insolation, great heat, and low humidity was a common cause of injury. Desiccation resulted in the death of the smaller branches, and permitted the entrance of wood borers, other insect larvae, and fungi. Desiccation and wood borers caused the death of the branches to proceed rapidly downwards; often the entire tree succumbed.

Effect of drought upon the radial growth of uninjured or least injured trees in western Kansas was ascertained. Trees that retained some life at the close of the drought usually remained alive unless infestation by wood borers was so complete or the trees so nearly dead that they were unable to resume growth. Recovery was shown principally by renewed growth locally within the crown. In dry sites, even after 3 or 4 years of good precipitation, leafy branches were sometimes few and foliage was sparse; but where drought had been less severe the foliage of the renewed portions of the crown was unusually dense. Where moisture was plentiful, the dead branches in the tops of the crowns were often soon obscured by new ones. Sprouts developed from the bases of some trees and grew rapidly. Dead trees were partly replaced by seedlings, but only where the trees grew naturally. In this manner Red Cedars (*Juniperus virginiana*) continued to replace their losses through the drought. Seedlings were not found in plantations, windbreaks or hedgerows in mixed prairie.

The report is illustrated by over 60 photographs. *From authors' summary.*

[655]. 42.22 : 12.25 : 11.49.0 : 11.47.2 : 12.14.3 : 23.24. Ladefoged, K. Virkning af Tørkeperioder. **[The effects of drought periods.]** *Dansk Skovforen. Tidsskr.* 28 (9), 1943 (389–428). [Dan.]

In podzolized mor soils, the active roots of Norway Spruce are mainly concentrated in, or practically confined to, two zones—(*a*) the humus layers, and (*b*) the illuvial horizon. The chief root development, representing most of the absorbing root surface of the tree, takes place in the surface humus, hence trees on mor soils have essentially shallower root systems than those of trees on mulls, and are more exposed to the effects of drought, which may act directly (by reducing moisture directly available to the tree) or indirectly (e.g. may affect tree growth by restricting biological processes in the upper soil horizons). A preliminary study of soil moisture inside old Spruce stands (including observations in the interior and along sunny margins exposed to wind) and on an open planting site, showed that in both wet and dry periods soil moisture was greater in the open than under stands. During drought the worst drying of the mineral soil occurred in the interior of stands, somewhat less in stand margins, and least in the open. The humus layers, however, dried most severely along exposed stand margins, somewhat less in the interior of stands, and least in the open. Whether under stands or in the open, a covering of slash was beneficial in reducing the drying-out of the surface humus, thus enabling root growth to continue either throughout the dry period or at least long enough for growth to be completed normally with the formation of root bark, so that death of the roots occurred on a very restricted scale only. Microscopic examination of wood from apparently healthy dominants showed that in an extreme drought year (1941) there was an abrupt transition from spring to autumn tracheids, the latter occupying an abnormally high proportion of the annual ring. In marginal trees, reduction of the ring was extreme and persisted in the next year though precipitation was normal in the latter. A tree that had become marginal as a result of a clear felling 7–8 years previously, had consistently reduced annual rings ever since. In view of these results, great importance is attached to the provision of shelter and the use of slash coverings to preserve as much moisture as possible on mor soils.

A few supplementary observations on moisture in planting pits showed that the 10–20-cm. soil layer, composed of a mixture of sand from the lower horizons with humus and some litter from the topmost horizons, maintained a higher moisture content during drought than did the 1–10-cm. layer, consisting of sand and gravel brought up from the illuvial horizon. It is recommended that the upper layer of mineral soil should be reduced, possibly to as little as 2 cm. in depth; that care should be taken in planting to place roots in such a manner that they can take advantage of the greater moisture in the mixed lower layer; and that a mulch of litter, etc., should be drawn round the plant. Autumn is to be preferred to spring planting.

42.3. *Precipitations*

[656]. 42.32. DELISLE, R. Les arbres et le verglas. **[Trees and glaze frost.]** *For. québec.* 11 (3), 1946 (225–9). [F.]

A glaze storm in January of this year caused severe damage to forest and ornamental trees within a radius of 25 miles of Quebec. The most serious damage consisted in the snapping off of the crown or the splitting of trees with double leaders. Many branches were broken off, an injury often accompanied by tearing of the bark below the branch. This article makes recommendations on the questions, which of the damaged trees should be felled and which can safely or profitably be left standing.

[657]. 42.32 : 12.25 : 31.8 : 42.1. LADEFOGED, K. Indre Brud i og Valkdannelser paa staaende Granstammer. **[Inner fracture in and 'lump' formation on standing Spruce stems.]** *Dansk Skovforen. Tidsskr.* 28 (11), (1943 (504–10). [Dan.]

An abnormal amount of wind breakage in Danish Spruce stands, including young, sound, apparently wind-firm stands, is attributed to previous inner failure of the wood, presumably caused by glazed frost in March 1942. The weight of the ice, combined with wind pressure, causes failure on the compression side of the stem, since the tensile strength of wood is greater than its compression strength. Trees so damaged are liable to wind breakage, especially if there is a strong wind from the direction of the side formerly in compression. Fractures of this type are often accompanied by lumps on the stem surface, but such lumps are not necessarily an indication of inner fractures—they are caused by folds formed in the bark on the compression side of bent stems, the bark being forcibly separated from the wood. Subsequently the cavity is filled by the rapid development of abnormal wood (figured) consisting at first largely of parenchyma and later of short, distorted tracheids. The lumps, as examined one year after the glazed frost, were up to 2 cm. thick, 10–15 cm. long (vertically) and 10–30 cm. broad (tangentially); they were most frequent on the lower one-third of the stems. Lumpy stems should be removed in thinnings as early as possible, before the defect attains considerable dimensions.

42.5. *Chemical Influences. Nutrient Deficiencies*

[658]. 42.5 : 12.25 : 21.3 : 11.47.1. NEILSON-JONES, W. **Further field observations on fused needle disease of Pines.** *Emp. For. J.* 24 (2), 1945 (235–9). [Bedford College, Univ. of London.]

In a paper published in 1941 [see *For. Abstr.* 3 (335)] the disorder known as fused needle, affecting Pines, was discussed and the susceptibility of different species compared. Nine years' observations of field experiments at Wareham Forest have shown that application of compost in the presence of adequate phosphate at sowing almost entirely prevents the development of fused needle in *Pinus contorta*, a species specially prone to this disorder in this area. Similar applications to a nine-year-old stand of *P. contorta* already showing 60 per cent. of the trees affected, has reduced the incidence of fused needle 50 per cent. in the course of 5 years. Basic slag alone produces definite amelioration, but the effect appears not to be lasting. *Author's abstract.*

43. FOREST FIRES

[659]. 43 (71). Beall, H. W. **Wartime influence on forest fires in Canada.** *For. Chron.* 22 (1), 1946 (25–9). [Dominion Forest Service, Ottawa.]

The total number of fires during the 5-year period 1940–44 was 10 per cent. less than in the pre-war fire seasons of 1935–39, but the size of the average fire (which has been used as a measure of the effectiveness of fire control) was 7½ per cent. higher. So far as the war period is concerned, this represents a creditable achievement on the part of the forest protection services; but when considered over a longer period the situation is far from reassuring. During the last 10 years the average fire was 20 per cent. larger than in the previous decade, and in the past 5 years the average fire size was 52 per cent. greater than it was in the period 1930–34, in spite of the fact that there were 19 per cent. fewer fires to control.

It appears from this analysis: (1) that the period of most effective fire control in the history of organized forest-fire protection in Canada coincided very closely with the depression years of the 1930's, and (2) that since that time there has been a marked increase in the size attained by the average fire before it is brought under control, for which the war can be held only partly accountable.

[660]. 43 (71) : 07.2. **Reports of research standing committees, 1945 [Canadian Society of Forest Engineers]: forest fire.** *For. Chron.* 22 (1), 1946 (56–62).

In an effort to prevent unnecessary duplication of fire research programmes by various organizations working independently, and often in ignorance of one another's activity, a list has been compiled, and is printed in this report, of the forest-fire research projects proposed by each agency in Canada for the 1946 season.

[661]. 43 (73). United States. **Forests and employment. Report of the Chief of the Forest Service [1944–] 1945.** U.S. Forest Service, Washington, D.C. 1946. pp. iii + 35.

Investigations are being made into the expenditure justifiable on fire protection in given areas and under given conditions. A study in the southern Piedmont of Virginia shows that, although fire losses are already fairly low, the sum of all costs and associated losses would be reduced to a minimum if protection expenditures were doubled, and the average annual area burned would perhaps be almost halved. The study has also developed methods for appraising flood, sedimentation, and erosion damage, and losses in yield of ground water attributable to fire. A similar study is nearing completion in the Pacific Northwest, and two additional areas are under investigation in the East, one in the mountains of south-western Virginia, and the other in the South Carolina coastal plain (pp. 30–31).

43.0. *Predisposing Factors and Causes*

[662]. 43.0. Fons, W. L. **Analysis of fire spread in light forest fuels.** *J. agric. Res.* 72 (13), 1946 (93–121). [California Forest and Range Exp. Sta.] O.R.E.

The analysis is based on the theory that the spread of a fire can be expressed as successive ignitions of adjacent fuel particles and that its rate is therefore governed by the time required to raise successive fuel particles to ignition temperature. Equations have been derived for rate of fire spread in homogeneous and heterogeneous fuel beds, taking into account the physical characteristics of the fuel particles, the arrangement of the bed, and the pertinent attributes of the atmosphere. The spread equations are expressed in terms of: film conductance; heat transfer factor for radiation; ignition temperature; fuel particle spacing; surface volume ratio of fuel; specific heat; density of fuel; and fuel temperature. The variables ordinarily recognized in field practice —wind velocity, fuel moisture, fuel density, fuel size, fuel bed compactness, slope, and time —influence fire spread only as they produce changes in the fundamental variables.

The results of field and laboratory experiments were used to check the theory and analysis, as well as to provide quantitative information for determining the magnitude of the effects of variables, measurable in field practice, on the rate of spread. *Author's summary.*

[663]. 43.0 (71.1). Fraser, F. A. **Forest fire prevention.** *B.C. Lumberm.* 30 (2), 1946 (54, 56).

Analysis of forest fire loss in the Coastal area of British Columbia in 1945 shows that 60 per cent. of loss was caused by fires resulting from failure to observe dangerous fire-hazard conditions, and 67 per cent. of loss was from fires which started in the immediate vicinity of the crew and which they were unable to extinguish because of inability to get water to the scene quickly. The author recommends the use of forest-fuel-moisture scales [cf. *For. Abstr.* 2 (157)] in combination with the following formula:—

When fuel moisture content at 8.00 *a.m. is*	*Operations should cease when air humidity drops to*
13 per cent.	30 per cent.
12 „	35 „
11 „	40 „
10 „	45 „
9 „	50 „
8 „	Cease.

It is estimated that if, in July, 1945, all logging operations had been using the foregoing formula to determine when to shut down, a total of 69 operating hours would have been lost, but 60 per cent. of the loss for the whole year would have been avoided.

The second measure which should be adopted generally, is to have water available before a fire starts. It is suggested that, where there is not sufficient water in the vicinity to operate a fire pump, an auxiliary water tank with a capacity of 500 gal. should be kept near the machine, and that during periods of fire hazard a fire pump should be set up ready to go, with hose ready to use.

[664]. 43.0 : 32.29.2. Gisborne, H. T. **Slash burns well at B.I. 10 to 20.** *Res. Note Nth. Rocky Mt. For. & Range Exp. Sta.* No. 35, 1944. pp. 2.

It is suggested that the Burning Index figures which are used as a guide to the number of men needed in fire control organization, might be adopted for determining safe periods for slash burning. Experiments show that by combining the Burning Index with the old rule of thumb of White Pine slash burners, the burning of slash can be planned with safety and efficiency at any time after 2 in. of rain have fallen *and when* the B.I. rating is between 10 and 20.

[665]. 43.01 (71.1). McQueen, I. **Forest fire weather.** *B.C. Lumberm.* 30 (2), 1946 (52, 58). [B.C. Forest Service.]

The article stresses the importance, in British Columbia, of dry air masses from the interior in creating dangerous forest fire weather. It is hoped to establish more meteorological stations, so that advance information of the movements of such air masses can be furnished to Forest Service and operators.

43.1. *Protective Measures*

[666]. 43.1 (485) : 92. Hjorth, R. Skogsbrandförsvaret enligt den nya brandlagen. Några kommentarer och reflektioner. **[Forest fire control under the new fire law. Some comments and reflections.]** *Svenska SkogsvFören. Tidskr.* 42 (5), 1944 (391–7). [Sw.]

The chief feature of the new law coming into force on 1st January, 1945 is that provision for fire control, whether of forest fires or otherwise, becomes an obligation for all communes, though considerable freedom is allowed in local arrangements, and all able-bodied persons between 17 and 65 may be called upon to serve on a local fire reserve made up in the first instance of volunteers. It is left open for local circumstances to decide whether forest fire-fighting shall be united with ordinary civil fire-fighting under one effective local head, or organized semi-independently which might often be in the interests of efficiency. Notes are included on questions of detail where change is involved.

[667]. 43.1 (71.3). Mackey, T. E. **Fire protection today and yesterday.** *Sylva, Toronto* 1 (1), 1945–46 (3–6).

A brief account of the development of forest fire protection in Ontario, and the need for further progress, particularly in the matter of communications and propaganda.

[668]. 43.1 (945). Lawrence, A. O. **Forest fire prevention.** *Aust. Timb. J.* 11 (12), 1945–46 (614–9).

The writer urges the necessity for intensive education of the public (from schoolchildren upwards) in the prevention of forest fire, which is peculiarly dangerous to the forests of Victoria owing to climatic conditions and the inflammable oils in the local species of trees and shrubs. A large proportion of fires in state forests originate on private property in the neighbourhood, and it is therefore necessary to concentrate defensive measures on the margins of the forests. It is particularly important that crown fires should not be allowed to develop, and the only way of preventing this is by carrying defence measures to the outer fringe of standing timber, at any rate to the north and west. This marginal fire-protection zone may have a width on rising mountain slopes of up to half a mile. It is not a cleared strip and cannot stop a crown fire which develops outside it (nor would a cleared strip of equal width do so), but no crown fire can develop within it.

[669]. 43.11 (73). HAYES, G. L. **Fire danger and forest fires.** *Sth. Lumberm.* 172 (2154), 1946 (52–3). [Appalachian Forest Exp. Sta., Asheville, N.C.]

The Appalachian Forest Experiment Station has recently analysed fire danger and forest fires for each of 14 North-eastern states for the 18 months from July, 1943 to December 1944, using records from more than 150 fire-danger stations. The following table for Virginia gives averages for each class of day from 1 to 4 with values for class 5 days extrapolated. Class 1 represents lowest fire danger and Class 5 highest.

Item	*Class of day*				
	1	2	3	4	5
No. of fires daily	·5	3	13	41	77
Acres burned	4·2	40	303	826	1,470
Dollars spent for suppression . . .	4·6	40	280	717	1,240
Dollars damage reported	15·4	168	1,152	4,531	8,610
Suppression-job load in man-hours . .	1·2	14	98	410	1,000

It is clear from these and other results from the analyses that it would be both more effective and economically more profitable, to concentrate such fire prevention measures as newspaper and radio warnings, cancellation of burning permits, railway locomotive inspections, etc., on the days of higher fire-hazard class. Look-out observers and trained crews should be on duty for more hours on such days. As many fires start between 6 and 7 a.m. on Class 4 days as start between 11 a.m. and noon on Class 2 days, and as many between 7 and 8 p.m. on Class 4 days as between 5 and 6 p.m. on Class 2 days. Larger fire-fighting crews must be sent to each fire on the higher-class days if equally effective suppression is to be obtained for all classes of days.

[670]. 43.12 (75.8). GROOM, P. **Airplane used for forest fire detection.** *Sth. Lumberm.* 171 (2153), 1945 (127–8).

Account of an experiment in the use of aircraft for forest-fire detection made in 1945 in middle Georgia. The plane was equipped with a 10-watt transmitter and each fire-control truck was equipped with a receiver. Pilot and truck driver carried identically gridded maps. Thus the pilot could locate a fire quickly on his map and direct the suppression crew to it. On days of fire hazard, warnings were dropped to sawmills, persons burning brush, etc., where there was a chance of their fires spreading to the woods. Patrols were flown only in fire-hazard weather and the experiment was operated in 73 hours of flying time, 6 of which were used for radio tests. Forty-five fires of a destructive nature were spotted, scattered evenly over the whole area (a total of 1,114,240 acres, of which 60 per cent. is forested). Ground crews' average time in reaching the scene of the fires was 15 minutes from the time of the patrol plane's first report. It is considered advisable for future use that all trucks should be equipped with two-way communication, so that planes and ground crews may work more closely together. To obtain close observation the plane must follow definite routes, planned from reports of weather stations at points over the area, which should give the visibility and degree of hazard in their neighbourhood.

Cost of operation ($8.0 an hour for hiring plane and pilot) could possibly be reduced if the Department owned and operated its own planes, and foresters with experience in fire-fighting were secured as pilot-observers.

[671]. 43.12. WARD, E. L. **The eyes of the forest: proper detection.** *Sylva, Toronto* 1 (2), 1945–46 (6–13).

An account of the organization of fire detection in Ontario by a combination of aircraft and tower detection. All towers are so located that a visibility coverage of about 12 miles is available. Any smoke observed within the radius of vision of a tower is instantly reported by radio or telephone to headquarters, and its location determined by a simple sighting instrument. Air reconnaissance is then used to confirm the location of the fire and provide information on its extent and rate of spread. Aircraft are also used to rush suppression crews to the scene of the fire. On days of poor visibility, responsibility for detection falls directly on low-flying aircraft; they are also essential for pinpointing smoke visible from only one tower. Though aircraft is the ideal means of detecting incipient fires, it is economically impracticable to keep enough planes aloft for anything like the period of observation which is possible from towers, and detection flights are usually confined to the mid-afternoon, when fires are most apt to break out and when visibility from towers is gradually decreasing. Only half the programme of tower-building planned in 1920 to be carried out over the next 20 years has been completed. The cost of an 85- or 100-ft. tower, including steel structure, transportation and erection, averages a little less than $1,000, and in addition there is the cost of telephone and radio equipment, current maintenance and observer's wages.

[672]. 43.12 : 07.7. Reichert, E. **How optical coating can help fire detection.** *J. For.* 44 (2), 1946 (98–9).

During the war a new process in optical manufacture was developed which should greatly assist the observer in the detection and identification of forest fires. Applied to binoculars, it increases optical efficiency by making details appear clearer and more distinct. The process consists in coating the lenses and prisms of binoculars with a metallic film of magnesium fluoride, ·000005 in. thick. The effect is to increase transmission of light and reduce glare. Reprints of this and of an earlier article on the use and care of binoculars can be obtained from the author, c/o the Mirakel Repair Co., Mt. Vernon, N.Y.

[673]. 43.13. Thompson, P. A. **Proper organization for control of large fires.** *J. For.* 44 (4), 1946 (266–71).

This paper stresses the importance of organization and staff work in ensuring efficient control of large fires, and lays down some of the principles on which it should be based. The chief of these is that enough force should be applied fast enough. Required suppression-force strength will vary with the region; the time of year; current weather; fire danger; volume, distribution and character of fuels; time which has elapsed between start of fire and attack; and many other factors. The fire manager must take all these into account in estimating the force required, and at the same time avoid over-expenditure. The second important principle is that of flexibility, the power to think and plan under rapidly changing conditions. The danger that fire-fighting will be rigidly conditioned by orthodox methods increases with increasing success in controlling all fires while they are small, since training for big fires tends to become purely theoretical or based on experience with small fires only.

[674]. 43.13 (485) : 07.7. Skogsbrandsläckningens teknik. Skogsbrandsläckningskommitténs erfarenheter. [**The technique of forest fire control. Experience of the Forest Fire Control Committee.**] *Svenska SkogsvFören. Tidskr.* 42 (2), 1944 (146–69). [Sw.]

Practical notes, in semi-popular form, under the headings:—terminology employed; need for rationalization of fire control; nature of forest fires from the point of view of control; methods of suppression (dry, wet, or combined); securing the lines on which control has been gained; mopping up; the cardinal rules of fire control; tools and apparatus. It is stated that though the utility of foam spraying in forest fire control cannot yet be assessed in full, foam so far appears to have no significant advantage over water rightly used, i.e. as a fine spray, and considerable emphasis is placed on the use of water, particularly when supplies are limited, to augment the effectiveness of control lines a short distance ahead of the fire, and in general, as an auxiliary to other measures.

[675]. 43.13 (73 : 71.1). **U.S. Forest Service experience shows way for 'smoke jumpers' in British Columbia.** *B.C. Lumberm.* 29 (11), 1945 (35–6, 42).

The U.S. Forest Service has a number of parachute units for fire suppression in rugged, mountainous and otherwise inaccessible country. It is suggested that British Columbia would benefit by having similar units, and that Canadian paratroopers provide a body of trained men from which such a Service might be recruited.

[676]. 43.13 : 11.62.21. HOOVER, M. D., and HURSH, C. R. **Installation of shallow observation wells.** *Tech. Note Appal. For. Exp. Sta.* No. 56, 1943. pp. 5.

A note on the installation of shallow wells for the purpose of observing water tables lying less than 15 ft. from the surface. The depth of the water table along the South Atlantic seaboard is a major factor controlling the ease of forest-fire suppression in the pocosins and swamp lands. When the water table is low, fires burn deeply into the organic soil, and deep ploughing and other unusual methods are required to control the fire. The Appalachian Forest Experiment Station, Ashville, N.C. has had considerable experience in the operation of shallow observation wells, and will answer specific questions on water-level recorders, housing designs, etc.

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

44.3. *Fungi*

See also *For. Abstr.* 8 (No. 245).

[677]. 44.3 (73) : 45.3. MCCUBBIN, W. A. **Preventing plant disease introduction.** *Bot. Rev.* 12 (2), 1946 (101–39). [U.S. Bureau of Entomology and Plant Quarantine.]

After outlining the methods of dissemination of pathogens, the author discusses the factors affecting national efforts to prevent the introduction of plant diseases. A troublesome factor of uncertainty is the inability to forecast the probable behaviour of foreign parasitic species in a new habitat. Pathogens regarded abroad as of trivial or minor importance have become formidable and destructive when introduced into the United States; examples are Chestnut blight, Citrus canker, White Pine blister rust and Walnut blight. Knowledge of foreign diseases is essential to the success of any quarantine system.

[678]. 44.3 : 12.25 : 12.21 (47.1). JAMALAINEN, E. A. Über die *Fusarien* Finnlands. I, II, III. **[On the *Fusaria* of Finland, I, II, III.]** *Valt. Maatalousk. Julk.* 122, 1943. pp. 26; 123, 1943. pp. 25; 124, 1944. pp. 25. [G. fin.] R.A.M. 25, 1945 (12–3).

Three lists, with brief historical and descriptive details, of the species of *Fusarium* found in Finland and pathogenic to crops and trees, including *F. sambucinum*, *F. avenaceum*, *F. solani*, *F. merismoides* and *F. arthrosporioides* on *Picea abies*, and *F. redolens* on *Pinus sylvestris*.

[679]. 44.3 : 12.25 : 12.21 (71.1). **Reports of research standing committees, 1945 [Canadian Society of Forest Engineers]: forest pathology.** *For. Chron.* 22 (1), 1946 (62–5).

An investigation has been completed on the Queen Charlotte Islands on the decays which attack Sitka Spruce. Detailed analysis was made of 1,977 trees, and information was gathered on relation of decay to age, diameter, vigour and locality. A local volume table has been constructed which indicates the correct allowance for defect in trees of the different diameter classes. Mimeographed interim reports on the work are available on application to the Laboratory of Forest Pathology, Victoria, B.C. A similar study on Western Hemlock is in progress.

A study of heartwood discoloration of Western Red Cedar has demonstrated that the major loss in Cedar is caused by fungi previously little known or not associated with decay in living trees. A much larger number of fungi than was expected have been found attacking Cedar, and many of these cause serious decay and discoloration. Work is in progress on the determination of the relative importance of the decay fungi, the recognition of incipient decay in sawn timber, and the capacity of the organisms to destroy timber in service.

An investigation was made of the decay entering basal scars in 60- to 70-year-old White Pine at Revelstoke, B.C. Scar damage is common in Pines of this region. The origin of the scars is unknown, but they appear to have been made about 30 years ago. The wood-destroying fungus *Stereum sanguinolentum* commonly entered these scars and caused considerably decay in affected trees. The frequent occurrence of this virulent organism in the basal logs of vigorous young growth may alter the management plans for Pine in this area (pp. 64–5).

[680]. 44.3 : 12.25 : 12.21 (79.4). WAGENER, W. W., and CAVE, M. S. **Pine killing by the**

root fungus, *Fomes annosus*, in California. *J. For.* 44 (1), 1946 (47–54). [Division of Forest Pathology, U.S. Bureau of Plant Industry, San Francisco, Calif.]

The root fungus *Fomes annosus* has been found to be a primary cause of death of Ponderosa and Jeffrey Pine of all ages in California. Sugar Pine and Coulter Pine may also be affected. The fungus has long been known as a source of serious loss in Europe but has not hitherto been so regarded in the United States. The common means of establishment at new centres in the Pine stands, and the reasons for the apparently greater virulence of the fungus in California as compared with other parts of the United States, are not known. The disease is confined almost entirely to light sandy soils in the drier portions of the Pine belt. Soils in affected districts in California gave reactions of pH 5·7 to 6·7 compared with pH 4·6 to 6·0 in Europe. *From authors' summary.* [Cf. *For. Abstr.* 8 (No. 303, 745).]

[681]. 44.3 : 12.25 : 12.21. La pourriture alvéolaire du bois des pins: Le polypore du pin. **[Pine heartwood rot: *Trametes pini*.]** *Ann. Éc. Eaux For. Nancy* 8 (1), 1941 (125–32). [F.]

A short account of the wood-rotting fungus, *Trametes pini*. Preventive measures suggested are destruction of fruiting bodies and exploitation of attacked trees. Stands of Pine should not be permitted to become overmature and pruning should be avoided.

[682]. 44.3 : 12.25 : 12.21. Rennerfelt, E. Om vår nuvarande kunskap om törskatesvampen (*Peridermium*) och sättet för dess spridning och tillväxt. **[On our present knowledge of the blister-rust fungus (*Peridermium*) and its mode of dispersal and growth.]** *Svenska SkogsvFören. Tidskr.* 41 (4), 1943 (305–24). [Sw.g.]

The *Peridermium* species attacking *Pinus sylvestris* in Sweden are *P. pini* (Willd.) Kleb. and *P. cornui* Rostr. and Kleb. The former has only an aecidial stage, the aecidiospores being capable of reinfecting Pine; the latter has an alternate stage (*Cronartium asclepiadeum* (Willd.) Fries) on *Cynanchum vincetoxicum*, *Paeonia* spp., *Pedicularis*, et al., the first two host genera being the only ones of practical importance in Sweden. In the aecidial stage the two species are indistinguishable or practically so. In 1942 and 1943 infection tests with aecidiospores from various districts showed that material from the south and south-east up to the Stockholm district would give positive results with *C. vincetoxicum* and *Paeonia*, but not with *Pinus*. This corresponds with the natural range of *C. vincetoxicum*, and *P. cornui* is thus indicated as the common species in this region. North Swedish material gave only one infection, and that on *Pinus*, and *P. pini* is believed to be the fungus concerned. Field studies confirmed previous reports that Pine shows individual differences in susceptibility to both fungus species. Infection of Pine is presumably via the stomata, and the mycelium subsequently passes through the branches into the main stem. Aecidia develop 2–3 years after infection. Artificial infection has been obtained through wounds on branches and young stems. In sections of infected stems taken to determine age of lesions, age at infection, etc., several species of insects were found, e.g. *Pissodes piniphilus*, *P. pini*, *Dioryctria splendidella*, and *Laspeyresia coniferana*, but it is not known whether any of these plays a part in natural infection. The only forms of control that appear possible are the removal of infected trees and the use of immune individuals for seed collection or as natural seedbearers. Old stems with old, resinous lesions usually appear to be uninfective.

[683]. 44.3 : 12.25 : 12.21 (489). Buchwald, N. F. Bør nye Douglasie-Kulturer anlægges i Øjeblikket? **[Should new Douglas plantations be established at present?]** *Dansk Skovforen. Tidsskr.* 25 (10), 1940 (521–7). [Dan.] Larsen, C. S. Plantning af Douglas. **[Planting of Douglas.]** *Dansk Skovforen. Tidsskr.* 25 (11), 1940 (579–82). [Dan.] Holm, F. Douglasiens Sodskimmel. **[The Swiss leaf-cast of Douglas.]** *Dansk Skovforen. Tidsskr.* 25 (11), 1940 (583–4). [Dan.] Holm, F. Douglasiens Sodskimmel. **[The Swiss leaf-cast of Douglas.]** *Dansk Skovforen. Tidsskr.* 29 (3), 1944 (125–9). [Dan.]

Buchwald lists 5 fresh localities for attacks by *Phaeocryptopus gaeumanni* in Denmark [cf. *For. Abstr.* 1 (142)]. The known localities in 1940 (map) were 4 in E. Jutland, 1 in Fyn and 3 in Sjælland, representing 3 foci of infection in the 3 most important regions of the country. He urges that recommendations similar to those made in S. Germany should apply to

Denmark also, viz. that seed collection from the foci of infection should be stopped, or, preferably, all further raising of Douglas from Danish seed should be discontinued.

C. Syrach Larsen considers undue pessimism to be unjustified. He refers to the shift of emphasis in recent forest pathological work from the fungi to other factors, such as maladjustments in climatic and cultural respects, etc., as possibly the primary causes of disease, and points out that S. Germany (where the worst damage has occurred) is farther removed than Denmark from the climatic optimum of Douglas. Planting of this species should continue, but only on the best Douglas sites and possibly in mixture with Norway Spruce. Reports on possibly resistant types are invited.

Holm (1940) questions whether some damage due to frost in the severe winter of 1939 may not have been wrongly ascribed to the disease. He strongly disagrees with Buchwald's recommendation, urges that, if resistant types are to be found, it is from healthy stands in infected areas that seed should be collected, and mentions as a possible example a good healthy stand of 'Green' Douglas (Oregon provenance) which was apparently uninfected though growing less than 100 m. from a seriously infected 'Grey' Douglas stand in the Giesegaard District.

Holm (1944) re-emphasizes the difficulty of distinguishing between the effects of frost and fungus damage, particularly in combination. In the case of a 'Grey' Douglas stand in the Giesegaard District climatic effects can be ruled out, and this stand, seriously infected in 1939–40, has shown much improved increment in the period 1941–43 and the attack may possibly be spent. Only 9 of the 190 trees were practically unaffected by the disease, and these are under review as possible seed trees. Some 'Green' Douglas reported as diseased in 1940 also give the impression that the attacks are on the wane. The Oregon 'Green' Douglas mentioned in Holm's previous paper may have suffered somewhat from frost but has remained quite free from *P. gaeumanni*. There is thus room for optimism and attention should be given to the use of climatically suitable races, to be sought in the first instance among existing stands of Douglas in Denmark.

[684]. 44.3 : 12.26–8 : 12.21. Juel, C. Grentørrens Smittefarlighed. **[The danger of infection with *Cryptospora suffusa*.]** *Dansk Skovforen. Tidsskr.* 25 (4), 1940 (154–9). [Dan.]

The author's experience runs counter to the general opinion that *Alnus glutinosa* is not attacked by *Cryptospora suffusa* unless the trees are weakened or of foreign provenance, and suggests that proximity to a source of infection is the main factor, owing to which he has been obliged to abandon the planting of Alder in the neighbourhood of infected trees or stands.

[685]. 44.3 : 12.26–8 (44) : 4. Kuhnholtz-Lordat, M. Le dépérissement des châtaigneraies cévenoles. **[Die-back of Chestnut groves in the Cevennes.]** *Ann. Éc. Agric. Montpellier* 26 (3), 1944. (32–4). [F.] [École Nationale d'Agriculture de Montpellier.] I.I.E.

Die-back of Chestnut is usually ascribed to Chestnut Ink disease, though the symptoms are very varied. Observations made in the Cevennes in July–August 1942 convinced the writer that the variety of symptoms was due to the roots being attacked by several destructive factors which might occur singly or together. Many Chestnuts were found, attacked by root rot but showing none of the symptoms associated with Ink disease, particularly the appearance of chlorosis. No one has yet paid much attention to a form of die-back common in the Cevennes, where it is known as 'fioc'. Excavation of the roots of trees affected by this condition showed that the root hairs had been invaded by some unknown insect; the roots were moniliform with numerous perforated swellings. He concludes that there is not a simple problem of Chestnut Ink disease with a single cause, but a problem of die-back with multiple causes, and suggests that it is possible that there is a virus disease, not so far identified, which predisposes trees to attack by other agencies. The following possible causes of die-back of Chestnut in the Cevennes are recognized:—

Parasitic agencies	Fungi	*Armillaria mellea* Root rot
		Phytophthora cambivora Ink disease
	Insect	"Fioc".
Non-parasitic agencies.	Still only hypothetical, and awaiting further investigation.	

[Cf. *For. Abstr.* 8 (No. 97).]

[686]. 44.3 : 12.26–8 : 12.21 (45). Woodruff, J. B. **Chestnut blight in Italy.** *Trees, Sta. Monica* 6 (4), 1946 (8–9, 16).

Fifteen per cent. of the total forest area of Italy carries Chestnut trees. The 2,240,000 acres of Chestnut land are composed of 1,176,000 acres of high forest for nut production and 1,065,000 acres of coppice for wood products. The average annual production of nuts, from some 62 million trees, is 770 million pounds, the greater part for home consumption, Chestnut flour being the principal food in some areas. The Chestnut blight (*Endothia parasitica*) was discovered near Genoa in 1938 and is now threatening the future of the Chestnut in Italy. There are now 3 centres of infection, near Genoa, Trieste and Naples, and it is probable that the disease was introduced separately in each case. By 1942 one-half of the 190,000 acres of Chestnut in the Province of Genoa had been infected. In general, trees from 12–16 in. diam. were dead or dying 8–10 years after introduction of the pathogen, and smaller trees took less time to succumb. Attempts at control by quarantine measures and burning of infected trees have met with little success, partly, no doubt, owing to war conditions.

The new coppice shoots are unlikely to be resistant, since many of the infected trees were of coppice origin. Japanese Chestnut (*Castanea japonica*), which is resistant in the United States, was badly infected by *Endothia* when planted at Busalla. It will probably need much experiment with blight-resistant strains before any attempt can be made to substitute one of them for the native Chestnut.

[687]. 44.3 : 12.26–8 : 12.21 (493). Roland, G. Une nouvelle maladie du chêne. **[A new disease of Oak.]** *Bull. Soc. for. Belg.* 52 (1–6), 1945 (28–33). [F.] [Station de Phytopathologie de l'Etat, Gembloux.] I.M.I.

During the years 1941–43, studies were made of a serious affection of Oaks in a badly infected wood in the Guignies region of Belgium. The affected trees showed a gradual dying of the twigs until they were completely defoliated, and death seemed to occur about 3 years after the first appearance of the disease. The causative agent has been identified as the fungus *Diplodia quercina* West., which apparently enters the twigs by wounds, notably those made by insects. The fungus seems unable to spread very far in the wood, and each twig, or at least each small branch, is separately infected from outside. Invasion by *D. quercina* is not, by itself, able to kill a twig, a necessary condition apparently being a disturbance in the supply of water to the leaves. Among the natural causes which favour the development of fatal symptoms are deficient precipitation, insolation, shallow soil; among silvicultural causes are all measures favouring the formation of gaps in the stand, exhaustion of soil moisture by invading plants (particularly bracken), and degradation of the soil. Since the parasite can fructify only on dead wood, the chances of dissemination increase in proportion to the number of dead twigs on a tree.

Control must take the form of removal of diseased and dead trees and of all fallen branches, filling up gaps in the stand with species not liable to attack and, where possible, measures against insects, particularly caterpillars. Beech and Chestnut have not been found infected in a natural condition, but have been successfully inoculated. They should not be used for filling gaps in an Oak stand unless conditions are particularly favourable to them. Further research is being carried out on this disease.

[688]. 44.3 : 12.26–8 : 12.21 : 12.11.3 (73). Waterman, A. M. **Canker of hybrid Poplar clones in the United States, caused by *Septoria musiva*.** *Phytopathology* 36 (2), 1946 (148–56). [U.S. Bureau of Plant Industry.]

A canker disease of hybrid Poplar clones is caused by *Septoria musiva*, an indigenous species occurring on living leaves of various species of native and exotic Poplars in the United States and Canada. The relative susceptibility of 10 clones of hybrid Poplars that have proved particularly adaptable for reforestation was tested by inoculations in the greenhouse and out-of-doors. The results indicate a high degree of susceptibility in one clone with a parentage of *Populus nigra* × *P. laurifolia*, two of *P. maximowiczii* × *P. berolinensis* and one of *P. maximowiczii* × *P. nigra* var. *plantierensis*. *From author's summary.*

[689]. 44.3 : 12.26–8 : 12.21 : 24.5. Buchwald, N. F., and Madsen, K. B. Plombering af Lindetræer, angrebet af Kulsvamp (*Ustulina vulgaris*). **[Cavity-filling operations on Lime trees attacked by *Ustulina vulgaris*.]** *Dansk Skovforen. Tidsskr.* 25 (11), 1940 (569–73). [Dan.]

[690]. 44.3 : 12.26–8. Connecticut. **Connecticut Agricultural Experiment Station: report of the Director for the year ending**

October 31, 1944. *Bull. Conn. agric. Exp. Sta.* No. 484, 1945 (55–103).

The most promising method of control for Dutch Elm disease and *Verticillium* wilt of Elm and Maple is the introduction of chemicals into the plant before infection.

The major symptoms of Dutch Elm disease are caused by a toxic by-product of fungous growth. The research has indicated: (1) that this toxin may be inactivated by such chemicals as 8-hydroxyquinoline sulphate; (2) that pre-infection treatments with such chemicals as 8-hydroxyquinoline benzoate may impart some immunity to the trees; and (3) that post-infective treatments may cure infection if not too long delayed.

It has been found that the probabilities of infection are very low at distances beyond 500 ft. and that pruning of infected wood may be valuable in the saving of individual trees (pp. 68–9). [Cf. *For. Abstr.* 8 (No. 723).]

[691]. 44.3 : 12.26–8 : 12.21 (74.9). REX, E. G. **Report on Dutch Elm disease control in N.J. for calendar year 1944.** *Shade Tree* 18 (3, 4), 1945. pp. 2 + 1. [Department of Agriculture, New Jersey.]

45. DAMAGE BY ANIMALS

45.1. *Mammals*

[692]. 45.12 : 13.2. MATHER, D. W., GENSCH, R. H., and BARTON, H. A. **Report on the snowshoe hare repellent and poison studies on the Nicolet National Forest in 1941 and 1942.** U.S. Forest Service [1943?]. pp. 36.

The studies described were designed to yield information on the value of repellent sprays applied to transplants and the effectiveness of certain poison paints applied to Aspen boughs and exposed to hares. Two qualities of the repellent sprays were tested: their effectiveness in deterring hares from eating the treated trees and their effect on the survival and growth of the trees. It was shown that a repellent such as T.P.109 does protect young transplants from snoeshoe hare attack as long as it covers the edible portion, but later new growth apparently receives no protection from the old spray. Follow-up spraying in the field seems to be the only way of continuing this protection. Further tests are necessary to determine the effectiveness and cost of this. Further studies on the effect of the spray on tree survival and growth are being made. The poison experiments were too limited to be of significant value but it is considered that further study should be given to the Aspen bough poison method.

[693]. 45.12 : 13.2 : 07.7. WILHJELM, G. Beretning om Forsøg vedrørende Bekæmpelse af Museskade i Skoven. **[Report on an experiment on the control of mouse damage in the forest.]** *Dansk Skovforen. Tidsskr.* 28 (6), 1943 (233–6). [Dan.]

Tests of sprayers for treating young plants with a mixture of 50 : 50 coal tar and crude benzol showed that a wheelbarrow type of hand sprayer gave too high a spray consumption to be economic. An ordinary back-packing horticultural sprayer, however, gave a total cost per ha. of only 15·50 Kr. (1 working day 8 Kr. + 50 litres spray 7·50 Kr.); the low spray consumption with this sprayer was due chiefly to the ease of handling, particularly the ease with which the spray could be directed on the individual plant without undue waste.

[694]. 45.12 : 12.25 : 13.2. METZGER, C. Om ekorren som skadedjur på tall. **[On the squirrel as a pest of Pine.]** *Skogen* 33 (8), 1946 (132). [Sw.]

In extension of an article by G. Norstedt [see *For. Abstr.* 7 (No. 1416)] some 19th-century cases are quoted of similar squirrel damage to conifers, especially Larch, which has the earliest period of sap flow, and reference is made to Schwerdtfeger's account (in *Waldkrankheiten*) of similar damage to both conifers and hardwoods. It is concluded that bark stripping by squirrels is likely to occur whenever they are deprived for any reason of their natural food; hence a watch should be kept on the availability of squirrel food, especially in early spring, when, if a shortage occurs, a ready gun and the protection of pine-martens should afford some control.

[695]. 45.12 : 12.25 : 13.2. ULLÉN, G. Tallungskogen och älgskadorna. **[Young Pine forest and elk damage.]** *Skogen* 33 (6), 1946 (100–1). [Sw.]

Elk damage to a young Pine stand which appeared extremely severe in spring 1935, when the trees were 11–12 years old, was visible in 1945 only on close inspection and had not seriously reduced height growth or density. Many trees will produce inferior timber, but the observations emphasize the ability of Pine, once it has reached a height of 3–4 m., to survive attack even if all but one of the shoots are lost. It is therefore possible to over-estimate such damage at the time of its occurrence. [Cf. *For. Abstr.* 8 (No. 645).]

45.3. *Insects*

See also *For. Abstr.* 8 (Nos. 245, 612).

[696]. 45.3 (89). TRUJILLO PELUFFO, A. El 'taladro', causa de grandes daños en los frutales y forestales de nuestro país. **[Wood borers, the cause of great damage to fruit and forest trees in Uruguay.]** *Bol. inform. Minist. Ganad. Agric. Uruguay.* 25th May, 1945 (213). [Span.]

A brief outline of the characters, life history and methods of control of *Stenodontes spinibarbis*, *Trachyderes morio*, *T. striatus*, *Compsocerus equestris*, and *Elaphidion collare*.

[697]. 45.3 : 12.12 : 13.2 : 44.3. FELT, E. P. **Plant galls and gall makers.** Comstock Publishing Company, Inc., Ithaca, New York. 1940. pp. vii + 364 + 41 plates + bblg. Price $4.00.

This book, which is a much enlarged revision of the same author's 'Key to American Insect Galls' (1917), is intended to give a general idea of insect galls and their producers, and to facilitate the identification of the hundreds of these deformities occurring upon numerous plants in all parts of North America. After a general introduction on gall insects and the process of gall formation, the main part of the work consists of a key to over 2,000 galls arranged according to the families of the host plants. There are 364 figures in the text in addition to 41 plates.

[698]. 45.3 : 13.2. IMPERIAL PARASITE SERVICE. **A catalogue of the parasites and predators of insect pests, prepared under the direction of W. R. Thompson, F.R.S., by the staff of the Imperial Parasite Service. Section I, Parts 1–4.** Parasite Service, Institute of Entomology. Imperial Agricultural Bureaux, Belleville, Ont., Canada. 1942–44. pp. ix + 151; v + 99; v + 149; v + 130.

The objects of the Institute of Entomology's Catalogue are: (1) the parasites and predators of any host insect recorded in literature, (2) the alternate hosts of the parasites and predators, if recorded and (3) the geographical distribution of any insect recorded either as a parasite, predator or host. Separate sections of the Catalogue deal with (1) parasite hosts, (2) parasites, (3) predator hosts and (4) predators. The first part now issued deals with parasite hosts of the groups Arachnida and Coleoptera; nine more parts will complete the parasite host catalogue; the remainder of the Catalogue will be issued in parts of convenient size.

There are only 3 pages of records for the Arachnida. The rest of the Part deals with the Coleoptera, the genera of which are arranged alphabetically for the whole order (not by families) and the species alphabetically in the genus. Under each host species the parasites are also arranged alphabetically and for each is given its order, family, range and literature reference (chiefly to the *Review of Applied Entomology*). The problem of nomenclature and the value to be attached to each name cited are discussed in the introduction.

[699]. 45.3 : 12.25 : 23.1 (485). FORSLUND, K.-H. Något om djurlivets inverkan på barrskogens naturliga föryngring. **[Note on the influence of animal life on the natural regeneration of coniferous forest.]** *Svenska SkogsvFören. Tidskr.* 42 (5), 1944 (366–76). [Sw.g.]

Recent investigation has shown that the fauna is an important factor, though only one among several, in the frequent inadequacy of natural regeneration of conifers in north and central Sweden. Twenty species so far identified as pests of coniferous seedlings are the slugs *Arion subfuscus* Drap. and *A. circumscriptus* Johnst. and the insects *Lygus pabulinus* L., *Otiorrhynchus dubius* Ström, *O. scaber* L., *Strophosomus rufipes* Steph., *Callophrys rubi* L., *Gonodontis bidentata* Cl., eleven noctuids and one tortricid. Most of these are common, widely distributed and polyphagous; often the leaves or bark of *Vaccinium* are their chief food, but conifer seedlings are taken eagerly and preferred to other food. In addition to these, wood mice have been found to eat conifer seed. Samples taken in northern, central and southern Sweden all showed a high frequency of the seedling pests under forest stands; on clear-felled areas they were normally fewer, and on areas where the mineral soil was exposed, seedlings were very little damaged by such pests. Control by poisoning is scarcely a practical measure, but it is plain that clear felling, with or without burning and cultivation, is unfavourable to the animals concerned. Sodium chlorate, recently under trial [cf. *For. Abstr.* 7 (Nos. 2030–1)] as a means of killing undesirable ground vegetation, may also possibly effect indirect control of seedling pests.

[700]. 45.3 : 12.25–8 : 13.2 (47.1). Györfi, J. Beiträge zur geographischen Verbreitung der Schlupfwespen in Finnland und zur Kenntnis deren Wirte. **[Notes on the geographical distribution of Hymenopterous parasites in Finland and their hosts.]** *Ann. ent. fenn.* 7 (2), 1941 (86–91). [G.] I.I.E.

Includes a list of Ichneumonidae, Braconidae, Chalcididae and Proctotrupidae with their hosts in Finland, and descriptions of *Pimpla kangasi* n. sp. from *Pissodes piniphilus* and *P. notatus*, and *Coeloides brevicaudis* n. sp. from *P. notatus* and *P. validirostris*.

[701]. 45.3 : 12.25 : 13.2 (77.4 : 77.5 : 77.6). MacAloney, H. J., and Secrest, H. C. **The more common insects attacking young coniferous plantations and natural stands on the national forests of the Lake States and suggestions for preventing and controlling injury.** U.S. Bureau of Entomology and Plant Quarantine. 1944. pp. 15. [Forest Insect Laboratory, Milwaukee, Wisconsin.]

Includes a key to identification based on the character of the injury and the stage of the insect; description of habits and damage, and control measures by groups or species of pests.

[702]. 45.3 : 12.25 : 13.2. Le lophyre du pin et le némate de l'épicéa. **[The Pine and Spruce sawflies.]** *Ann. Éc. Eaux For. Nancy* 8 (1), 1941 (81–6). [F.]

Brief descriptions of *Diprion* (*Lophyrus*) *pini* L. and *Nematus abietinus* Christ. and control measures. Spraying with arsenates is recommended against the first species, and with a mixture of water, petroleum and black soap against the second.

[703]. 45.3 : 12.25 (71.1 : 71.21). **Reports of research standing committees, 1945, [Canadian Society of Forest Engineers]: forest entomology.** *For. Chron.* 22 (1), 1946 (49–55).

In studies of the Larch sawfly in Manitoba and Saskatchewan, special attention has been given to the dispersal of the introduced parasitic wasp *Mesoleius tenthredinis* and the introduced parasitic fly *Bessa selecta*. *Mesoleius* has not only survived periods of low endemic sawfly populations, but has dispersed for distances of over 100 miles from points of liberation in 1912–13. The Spruce budworm outbreak in Manitoba has continued to spread. This is the only known Spruce budworm outbreak in the Prairie Provinces, and is unique among outbreaks in the eastern half of North America in that it has maintained itself and intensified in stands of pure White Spruce in which Balsam is entirely lacking (p. 52).

The European Larch sawfly has become distributed throughout the range of Western Larch in British Columbia since its first appearance in the Province 15 years ago. In 1934 the parasitic wasp, *Mesoleius tenthredinis* was introduced into British Columbia and it has now become dispersed throughout the range of the Larch sawfly in the Province by natural spread supplemented by the establishment of colonies. In recent years parasitism of Larch sawfly has increased to high proportions, *Mesoleius* and *Tritneptis klugii* being the two most important parasites (p. 53).

[704]. 45.3 : 12.25 : 13.2. Smith, S. C. **Studies of the genetics of the Spruce budworm.** *Bi-m. Prog. Rep. For. Insect Invest. Dep. Agric. Canada* 1 (5), 1945 (2–3).

The question, what relationship exists between the two budworms infesting Balsam/Spruce and Jack Pine respectively, is receiving close attention at the genetics Laboratory at Laniel, P.Q. Experiments have shown that opposite sexes of the two forms will mate, that the cross-mated females lay viable eggs which produce healthy offspring, and that the first-generation individuals, when bred together or mated back to the parental forms, are themselves fertile and produce second-generation larvae. Both forms carry 60 chromosomes (30 different ones, each represented twice). In the first generation produced in the laboratory it was observed that instead of the 30 chromosomes from the Balsam parent always associating with the 30 from the Jack Pine parent, the pairing relationship was sometimes 28 pairs and an association of 4. The genetical significance of this is that such hybrids will be partly sterile. The sterility factor acts as a barrier preventing crossing between the two forms from being completely successful. It is concluded that we are here dealing with species in the making which, owing to the chromosomal differences between them, and the physiological and seasonal differences they have created, must eventually diverge more and more and so attain full specific rank.

Since it is possible to produce hybrids between the two forms in the laboratory, it is almost certain that they would occur naturally in the forest if it were not for the fact that the Jack Pine form matures later. This lag in development is, however, small and could be easily bridged by, say, mass flight between climatically different regions. As a result, other new forms might arise particularly suited to feeding on another softwood, such as Black Spruce or Larch. In support of this assumption, it may be mentioned that in the laboratory it has been found easier to rear young first-generation larvae on Larch than on either Balsam or Jack Pine. It is necessary that a steady watch should be maintained by competent men trained to recognize these cross-bred forms, in order that protective measures can be initiated before they attain destructive numbers.

[705]. 45.3 : 12.25 : 13.2 : 24.3. Hodson, A. C., and Zehngraff, P. J. **Budworm control in Jack Pine by forest management.** *J. For.* 44 (3), 1946 (198–200).

Recent studies have shown conclusively that outbreaks of the Jack Pine budworm (a variety of *Cacoecia fumiferana* whose attacks are usually confined to *P. banksiana*), are closely correlated with an abundance of staminate flowers, which are an essential part of the budworm's diet. The authors present new data on the relation between classes of trees and staminate-flower production. A field examination made in May 1944 of a well stocked 35-year-old stand showed that the suppressed and intermediate trees and most of the orchard-type trees bore a heavy crop of flowers as compared with the co-dominant and dominant trees, and that trees of poor vigour, as indicated by thin crowns and short needles, showed a much greater abundance of staminate flowers than those of good vigour. A check of the abundance of budworm larvae in representative trees of the various crown classes, showed the greatest number in the two lowest vigour classes. A parallel study was made in a portion of the same stand, thinned 15 years previously, so that suppressed and intermediate trees and trees of poor crown densities were absent. The residual trees, mostly dominant or co-dominant, were growing vigorously, and staminate flowering throughout the stand was very light. Younger stands in the same locality showed the same relationship, down to trees only 10–12 years old.

As soon as suppression is evident in a natural stand of Jack Pine reproduction, the suppressed trees begin to flower heavily and are also infested with budworms. Jack Pine is rather intolerant of shade, and once it becomes suppressed and loses its vigour it never responds to release, but dies from sudden exposure. A rational management of Jack Pine, therefore, necessitates continuous removal of trees of poor vigour, which can best be effected by frequent intermediate cuttings or thinnings for pulpwood and other small products. This study suggests, furthermore, that the removal of trees of poor or declining vigour will reduce the budworm population in the stand to the point where serious outbreaks would be less probable.

[706]. 45.3 : 12.25 : 13.2. Le chermes du sapin: *Dreyfusia nüsslini* et *Dreyfusia piceae*. **[The Fir Chermes: *Dreyfusia nüsslini* and *D. piceae*.]** *Ann. Éc. Eaux For. Nancy* 8 (1), 1941 (103–7). [F.]

Dreyfusia nüsslini, of which an account is given in this bulletin, is a dangerous pest of Fir at low altitudes, particularly in warm aspects, and appears to be increasing. Damage may be limited by application of a 5-per-cent. lysol spray. Unlike this species, which attacks the needles, *D. piceae* is found in the bark of young Firs and is less harmful.

[707]. 45.3 : 12.25 : 13.2 (494). Schneider-Orelli, O. Weitere *Dreyfusia*-Untersuchungen. **[Further investigations on *Dreyfusia*.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 24 (1), 1945 (105–32). [G.g.f.]

To facilitate a survey by forest officers of the distribution of *Dreyfusia nüsslini* on Silver Fir in Switzerland, the paper reviews the generic characters of *Pineus*, *Dreyfusia*, *Adelges*, *Sacciphantes*, *Cholodkovskya* and *Gilletteella* and gives a method of separating, macroscopically and microscopically, mixed infestations of *Dreyfusia nüsslini* and *D. piceae*. Dusting and spraying have limited control possibilities; infestation can be checked but rarely completely controlled by such measures.

[708]. 45.3 : 12.25 : 13.2 (47.1). Lovászy, P. Fliegenlarven als Zapfenschädlinge. **[Fly**

larvae as cone pests.] *Ann. ent. fenn.* 8 (1), 1942 (79–83). [G.] I.I.E.

Young healthy cones of *Larix sibirica* and *Picea abies* are attacked by *Chortophila laricicola* Karl and *Hylemyia* sp. (probably *anthracina*) respectively. Two to three larvae are usually found in each infested cone, the seeds of which are destroyed. Larvae of *C. laricicola* were sometimes parasitized by *Epiurus* sp. and *Eurytoma* sp., while an endoparasitic Cynipid was found in larvae of *Hylemyia anthracina*.

[709]. 45.3 : 12.25 : 13.2. Kangas, E., and Leskinen, K. *Pegohylemyia anthracina* Czerny (Dipt., Muscidae) als Zapfenschädling an der Fichte. **[*Pegohylemyia anthracina* as a pest of Spruce cones.]** *Ann. ent. fenn.* 9 (3), 1943 (195–212). [G.] I.I.E.

The morphology of the imago, larva and pupa of *Pegohylemyia anthracina* Czerny is briefly described and figured. In Finland, it attacks Spruce cones mainly on the comparatively light side of trees on forest margins. As *P. anthracina* is usually the first pest of the season to develop on the cones, the damage done is obscured by that of other pests occurring later in the season, but it alone destroys at least one-third of the seeds, mainly those in the middle and apex where the best seeds are found. Among the parasites of *P. anthracina* are *Spermatolonchaea inquilina* Hendel, and *Asyncrita scutellata* Hellén.

[710]. 45.3 : 12.25 : 13.2 : 23.23.1. Ursin, E. Insektangreb paa Kogler af Rødgran [*Picea abies* (L.)], Vinteren 1942–43. **[Insect attacks on cones of Norway Spruce in the winter of 1942–43.]** *Dansk Skovforen. Tidsskr.* 28 (6), 1943 (270–87). [Dan.]

Of sample cones sent in for examination 49·6 per cent. showed attack by *Laspeyresia strobilella* (L.), 20·3 probably (on the evidence of type of damage and excreta) by *Dioryctria abietella* Schiff., and 34·9 by *Perrisia strobi* Winnertz, only 21·7 being free from insect damage.

The author's experience disagrees with Escherich's claim that scales of cones attacked by *L. strobilella* will not open properly and so will imprison any sound seeds. Contrary to previous opinion he also believes that the larva of this species first feeds on the seeds, working from seed to seed and leaving excrement in the vacated seeds until autumn, when, having eaten 20–30 seeds, it migrates into the medulla of the cone axis. It is uncertain whether true feeding occurs in the axis or whether the latter is used only for winter quarters.

D. abietella is the most destructive cone insect in Denmark but is less common than *L. strobilella*. It feeds primarily on the wood of the cone scales, completely destroying them. The seed is probably not eaten but destroyed by the severance of its connexion with the cone. *P. strobi*, the only cecidomyid found in the cones examined, appears to be harmless, not damaging the seed in spite of the often large (up to 300) larval population per cone, but feeding only on the swollen tissue of the scales.

In connexion with the problem of distinguishing cones of different ages, it is stated that a good spot character is the colour of the resin exudation at the base of the scales, which is light yellow-brown in cones of the year and dark red-brown in older cones, a difference which persists even after heating and drying, or after immersion in water for several weeks.

[711]. 45.3 : 12.25 : 13.2. Kangas, E., and Lovászy, P. Zur Biologie und forstlichen Bedeutung von *Callimome azureum* Boh. (Hym., Chalcididae). **[On the biology of *Callimome azureum* and its importance in forestry.]** *Ann. ent. fenn.* 6 (4), 1940 (publ. 1941) (140–54). [G.] I.I.E.

Callimome (*Torymus*) *azureum* Boh. is not a pest of Spruce cones, as some writers have supposed, but is a parasite of *Perrisia strobi*. Characters to distinguish its larva from that of *C. caudatum* Boh. are given.

[712]. 45.3 : 12.25 : 13.2 (47.1). Lovászy, P. Beobachtungen über die Biologie und das Auftreten des Fichtenzapfenwicklers (*Laspeyresia strobilella* L.) und seiner Parasiten. **[Observations on the biology and occurrence of *Laspeyresia strobilella* and its parasites.]** *Ann. ent. fenn.* 7 (2), 1941 (93–103). [G.] I.I.E.

Description of the damage caused by the larvae of *Laspeyresia strobilella* to Spruce cones and seeds, a map of its distribution and incidence of parasitism in Finland. Infestation is generally much more severe in the north than in the south and east of the country, probably owing to the relatively lower percentage of parasitism. Similar incidences have been recorded in north and south Sweden.

[713]. 45.3 : 12.25 : 13.2. Baeta Neves, C. M. Bóstricos e hilésinas. **[Bark beetles [in Portugal].]** Direcção Geral dos Serviços

Florestais e Aqüicolas, Lisboa. 1941. pp. 15. [Port.] Repr. from *Junta nac. Resinosos*, 1941.

A comparison of the common or vernacular names used for bark beetles in Portuguese, German, French, Spanish, Italian, and English; 'bóstricos' are *Ips sexdentatus* and *I. erosus*, 'hilésinas' are *Myelophilus piniperda*, attacking Pinheiro Bravo (*Pinus pinaster*). Notes on damage and control.

[714]. 45.3 : 12.25 : 13.2 (47.1). Kangas, E. Über die Larve und die Lebensweise von *Nothorrhina muricata* Dalm. (Col., Cerambycidae). **[On the larva and life history of *Nothorrhina muricata*.]** *Ann. ent. fenn.* 6 (3), 1940 (71–7). [G.] I.I.E.

The larval tunnels of *Nothorrhina muricata* in the outer bark of living Pine are not harmful to the tree. In general the bast remains undamaged.

[715]. 45.3 : 12.25 : 13.2 (47.1). Kangas, E. Zur Biologie und Verbreitung der *Pissodes*-Arten (Col., Curculionidae) Finnlands. Nachtrag. **[On the biology and distribution of *Pissodes* spp. in Finland. Appendix.]** *Ann. ent. fenn.* 7 (2), 1941 (91–2). [G.] I.I.E.

Records 4 species parasitic on *Pissodes* spp. in Finland.

[716]. 45.3 : 12.25 : 13.2 (47.1). Lovászy, P. Ruskean mäntypistiäsen (*Diprion sertifer* Geoffr.) loisista. **[Parasites of *Diprion sertifer*.]** *Ann. ent. fenn.* 6 (3), 1940 (62–6). [Finn.g.] I.I.E.

Morphological data on the larvae of *Exenterus abruptorius* Thunb., *Microcryptus basizonius* Grav., and *Lamachus frutetorum* Htg.

[717]. 45.3 : 12.25 : 13.2 : 13.15. Kangas, E. Beitrag zur Biologie und Gradation von *Diprion sertifer* Geoffr. (Hym., Tenthredinidae). **[On the biology and mass increase of *Diprion sertifer*.]** *Ann. ent. fenn.* 7 (1), 1941 (1–31). [G.] I.I.E.

Parasites cause the greatest mortality of *Diprion sertifer* although the higher animals and fungous diseases also play a part. Biological records are given for *Microcryptus basizonius* Grav., *Exenterus abruptorius* Thunb., *E. marginatorius* Fabr., *Lophyroplectus luteator* Thunb., *Lamachus* (*Torocampus*) *eques* Hart., and *L. frutetorum* Hart; *Microplectron fuscipenne* Zett., and *Sturmia inconspicua* Meig. The first two species are responsible for 79 per cent. of the pupal deaths from parasites. Most of the species parasitize more than one species of *Diprion* and are able to transfer to alternative hosts when the *D. sertifer* population is declining. On the other hand, the general occurrence of delayed emergence of *Diprion sertifer* is an important factor influencing the course of mass increase and can on occasions contribute materially to sudden outbreaks of the pest. Three tables are included: (1) pupal mortality in *Diprion sertifer* and its causes (parasites 48, predators 13, and fungi 15 per cent.) (2) percentage mortality caused by each species of parasite; and (3) a list of the *Diprion* parasites so far recorded in Finland. [Cf. *For. Abstr.* 7 (No. 2070).]

[718]. 45.3 : 12.26–8 : 13.2 (47.1). Kangas, E. Forstentomologische Studien an einigen Laubhölzern. **[Forest entomological studies on some hardwoods.]** *Ann. ent. fenn.* 8 (2), 1942 (142–63). [G.] I.I.E.

An investigation of the rôle of insects in the die-back of Mountain Ash [*Sorbus aucuparia*], Sallow [*Salix caprea*], Alder [*Alnus incana*], and Birch in Finland. *Agrilus mendax* and *Saperda scalaris* cause the most serious damage to Mountain Ash; while *Cryptorrhynchidius lapathi* is the most important pest of Willow. Brief biological notes are appended on: *Agrilus mendax*, *A. viridis*, *Saperda scalaris*, *Cryptorrhynchidius lapathi*, *Xiphydria prolongata*, *Cossus cossus*, and a pyralid (?) larva whose method of attack closely resembles that of *C. lapathi*.

[719]. 45.3 : 12.26–8 : 13.2 (47.1). Kangas, E. Zur Biologie von *Trypophloeus alni* Lindem. (Col., Scolytidae). **[On the biology of *Trypophloeus alni*.]** *Ann. ent. fenn.* 6 (3), 1940 (41–50). [G.] I.I.E.

Observations on the biology of *Trypophloeus alni* Lindem. found on *Alnus incana* in Finland, and previously recorded only from central and northern Russia.

[720]. 45.3 : 12.26–8 : 13.2 : 34.24. Pereira Machado, D. Influência do ataque de lagarta da *Lymantria dispar* L. na produção da cortiça 'folhada'. **[Influence of attack by the caterpillar of *Lymantria dispar* on the production of 'laminated' bark.]** *Suppl.* to *Bol. Soc. port. Sci. nat.* 13, 1942 (337–41). [Port.]

Bark of *Quercus suber* which splits into two concentric layers when struck with an axe is unsuitable for the manufacture of corks. This defect may be associated with *Lymantria dispar* attack. Defoliation has scarcely any influence on the quantity of bark produced but reduces its quality by about 30 per cent. [Cf. *For. Abstr.* 8 (No. 574).]

[721]. 45.3 : 12.26–8 : 13.2. RANDELL, P. C. **Insect attack on *Khaya.*** *Farm and Forest* 6 (3), 1945 (163). [Forest Department, Nigeria.]

Of insects attacking young living *Khaya* spp. in the Gold Coast, *Hypsipyla* and an unidentified stem borer are the most injurious. Another borer of the bole and branches of apparently healthy trees standing on farmed land is a buprestid. A large cerambycid attacks recently cut logs.

[722]. 45.3 : 12.26–8 : 13.2 (47.1). KANGAS, E. Forstentomologische Studien an der Espe. **[Forest entomological studies on Aspen.]** *Ann. ent. fenn.* 8 (1), 1942 (49–71). [G.] I.I.E.

A short biological account of the insects responsible for Aspen (*Populus tremula*) mortality; the south Finnish group includes: (*a*) *Agrilus ater* and associated species; and (*b*) *Poecilonota variolosa* and associated species; and the north Finnish group (which appears also in the southern part of the country) is composed of *Saperda carcharias* and a few other species. Greatest damage is done by *Poecilonota variolosa*, *Agrilus ater*, *Xylotrechus rusticus*, *Saperda perforata*, *S. carcharias*, *S. populnea*, *Cryphalus bispinulus*, *Xyleborus cryptographus*, *Aegeria apiformis*, *Cossus cossus*. Less important are, *Necydalis major*, *Acanthoderes clavipes* and a microlepidopteran. Dying-back usually takes at least 5 years.

[723]. 45.3 : 12.26–8. CONNECTICUT. **Connecticut Agricultural Experiment Station: report of the Director for the year ending October 31, 1944.** *Bull. Conn. agric. Exp. Sta.* No. 484, 1945 (55–103).

Elms will stand considerable defoliation and still survive. Trees defoliated completely twice a year for two successive years showed a marked retardation in growth and extensive dieback occurred. No bark-beetle attacks followed. Elms defoliated by cankerworms are more susceptible to the Dutch Elm disease presumably because of the lengthened period of springwood formation (pp. 66 and 68). [Cf. *For. Abstr.* 8 (No. 690).]

[724]. 45.3 : 13.2 (44). Les termites de France. **[The termites of France.]** *Ann. Éc. Eaux For. Nancy* 8 (1), 1941 (117–23). [F.]

Calotermes flavicollis, *Reticulitermes lucifugus* and *R. flavipes*, are found chiefly in south-west France. Control and defence measures are indicated.

46. DAMAGE BY MAN

[725]. 46 : 24.51. Les blessures des arbres. **[Tree wounds.]** *Ann. Éc. Eaux For. Nancy* 8 (1), 1941 (87–102). [F.]

Where wounds on trees cannot be prevented, they should be painted with a protective coat. Tar, which is frequently used for this purpose, is less effective than the various carbonyls, which have greater penetration. To reduce injury to a minimum, pruning should be done only on small branches, as close to the trunk and as clean as possible, preferably at the end of the winter. In the case of forest trees, natural pruning should be encouraged wherever possible and artificial pruning used only on Poplars and the dead branches of conifers. Ornamental trees should be pruned only when young.

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES AND TIMBER

[726]. 52. GUILHERME DE ALMEIDA, D. Contribuição à dendrometria das essências florestais. **[Notes on forest mensuration.]** Serviço de Informação Agricola, Ministério da Agricultura, Rio de Janeiro. 1943. pp. ix + 258 + map. [Port.]

After a discussion of methods for determining tree height and diameter, numerous examples are given of surveys of particular areas and tree species near Garea, Rio de Janeiro. Data given include name of the species studied; area of the site; topography, exposure, slope and soil; history of the plantation; cultural treatment; natural reproduction; age and number of trees; maximum and minimum diameters; maximum and minimum heights; and number of classes present.

[727]. 52 : 07.7 : 01.7. Moltesen, P. Lidt om Træmaaling. **[A note on tree measurement.]** *Dansk Skovforen. Tidsskr.* 28 (12), 1943 (517–32). [Dan.]

A brief description, with figure, is given of a caliper combining features of the Schulze and the Aldenbrück-Friedrich types, with an improved system of rollers and springs to stabilize the movable arm, screw work all countersunk, and a recess in the movable arm to facilitate reading of the scale, which is a $\frac{1}{2}$-cm. one specially designed for legibility.

Stress is laid on the need for as much accuracy as is attainable in practice and for better knowledge of the errors involved in practical measurements. Some examination figures are quoted to illustrate the considerable divergencies between students' and examiner's measurements of basal area and height on the same plots, and the sources of error are discussed. In the case of basal area, the students' measurements were all lower than the examiner's, a fact which is attributed mainly to 'play' in the calipers, e.g. 4 mm. play would allow of a minus error of about 3 per cent., the addition of which to the figures in question would bring the variation within reasonable limits. A special plea is made for the publication of studies of errors in measurement, for which, it is considered, much unpublished information must be available.

52.2. *Height. Length*

[728]. 52.2 : 07.7 : 52.1. Bistrup, C. Kluppen som Højdemaaler. I. II. **[The calipers as a hypsometer. I. II.]** *Dansk Skovforen. Tidsskr.* 28 (5; 6), 1943 (189–94; 267–9). [Dan.]

An account of two ways of using the Eschers caliper to measure tree heights.

(i) On the fixed arm is found the point of balance at which the caliper, when suspended, will rest with its stem vertical. At this point a loop is attached into which the left thumb is inserted and the instrument lifted until the right eye, applied to the scale on the stem, sights a fixed point at the butt of the tree in line with the top of the movable (lower) caliper arm. The caliper is held firm with the right hand until the left has been removed to grip the butt of the movable arm, when the right hand can be used to slide the stem vertically until a sighting via the tip of the fixed (upper) arm coincides with the tree top. The top and butt sightings are then checked and the reading taken on the ordinary stem scale at eye level. The theory of the method is plain if a diagram is made, and the procedure is claimed to be much less awkward than it sounds. It is essential to keep the eye at a fixed distance from the stem scale. Either a measuring rod placed against the tree or ordinary measurement of horizontal distance may be used; in the latter case it is necessary to determine an individual constant by taking readings on a known height at a known distance. The mean error of 76 readings, some in windy weather, on the same Spruce tree, using an 8-m. measuring rod, was 1·37 per cent. The best results are obtained when the angle of sighting is about 45°. The disadvantage of this method is that calculation is necessary to obtain height from the readings; its advantages are the good light for sighting and the absence of trouble with a plumb-line in high wind.

(ii) To the inner sides of both the fixed and the movable arms are attached centimeter scales with a pin at each cm. from which a plumb-line may be suspended (using pins on the fixed arm for top sightings and those on the movable one for butt sightings). A wooden rider clipped on to the stem between the arms, and a lateral pin near the base of the fixed arm, provide for sighting parallel with the stem. To use, the plumb-line is suspended from a pin distant the same number of cm. from the inner edge of the stem as is the observer in metres from the tree. On sighting along the rider and pin, the plumb-line will then cut the centimeter scale of the stem at a number of cm. equivalent to the height of the tree in metres. In windy weather the mean error of 56 readings was 1·38 per cent. and in still weather 17 readings gave a mean error of 0·61 per cent.

[729]. 52.2 : 07.7 : 52.1. Bistrup, C. Kluppen som Højdemaaler. **[The calipers as a hypsometer.]** *Dansk Skovforen. Tidsskr.* 29 (5), 1944 (214). [Dan.]

A brief note on Felber's caliper-hypsometer, which is said to give results comparable in accuracy to those of Faustmann's hypsometer. The instrument has a plumb-line attached near the top of the fixed caliper arm and a centimeter scale on the movable arm with its zero point at the same distance from the stem as that of the pivot of the plumb-line. In use, the horizontal distance to the tree is set off in centimeters on the caliper scale and the movable arm set at this reading; a sighting is then taken on the top of the tree along the inner side of the fixed arm, and the height is read off where the plumb-line cuts the scale on the movable arm.

52.4. *Measurement of Volume*

[730]. 52.43 : 54 : 52. 3 : 01.7. HAGBERG, N. Utbyteskalkylerna och stamformen. Jämförelser mellan beräknat och uppmätt timmerutbyte ur stämplingsposter jämte undersökningar över den individuella stamformens samt rotansvällningens betydelse för kalkylerna. **[Yield calculations and stem form. Comparisons of calculated and measured log yield from fellings, and investigations on the importance in the calculations of individual stem form and the root swelling.]** *Svenska SkogsvFören. Tidskr.* 42 (6), 1944 (403–14). [Sw.sw.]

Disregarding all corrections for crook, rot and similar defects, calculation with the aid of Höjer's formula of the yield of top and butt sawlogs obtainable from 246 Pine and Spruce stems gave results practically free from error, and for large lots of ordinary timber the error would amount to an inconsiderable percentage of the volume and value of the logs produced. A requisite condition, however, is that d.b.h. values (or those for diameter at a greater height), heights, and form quotients shall be correct; in particular, allowance must be made in d.b.h. values for the root swelling, otherwise the risk is introduced of an over-estimate of about 10 per cent. Attention is also given to the possible gains in log yield that may be secured by skilful marking of the lengths to be cut (especially where stems of different taper classes are mixed and where full advantage is taken of irregularities in stem form), and to the losses in yield that result from rounding off measurements to the next lower figure. It is concluded that such gains and losses are often practically equal, so that calculation of the yield in log lengths could be made direct, using the diameters shown by Höjer's stem formula or the corresponding taper tables. Under the usual conditions such a calculation, based on the mean stems of the diameter classes, would give no considerable error, though in some cases account would have to be taken of the dispersion of the stems around the mean. The number of sample trees needed for calculation of the yield in log lengths is probably about double that required in determining volume by sampling [cf. *For. Abstr.* 7 (No. 2088)], and if stem defects were frequent the number required would be still larger.

[731]. 52.43.2 (485) : 92. Auktoriserad virkesmätning. **['Authorized' scaling.]** *Svenska SkogsvFören. Tidskr.* 42 (3), 1944 (246–8). [Sw.]

Details of legal prescriptions whereby, in cases of compensation for specified types of wood and timber, one party can demand that scaling shall be done by an authorized body or person.

[732]. 52.43.2. MCMAHAN, M. B. **A new log scale.** *Sth. Lumberm.* 171 (2151), 1945 (57).

The writer has devised a log scale which he claims will accurately gauge the actual feet which can be sawn out of any lot of logs of any sizes from 6 to 24 in. The scale (which is given in the article) is based on the formula

$$\text{Board Feet} = L\,\frac{(D-2)^2}{21}$$

where L = length of log in ft. and D = diameter of log at small end in inches. The formula does not taken into account the taper of the log, which the writer assumes is offset by footage lost through minor defects.

[733]. 52.43.2 : 33.52. **Yields from tie bolts.** *Tech. Note Lake States For. Exp. Sta.* No. 194, 1943. p. 1.

A table showing the number of sleepers and the amounts of side lumber, slabwood, edgings and sawdust obtainable from an average run of acceptable 8-ft. hardwood bolts of different top diameters.

[734]. 52.43.2 : 52.3 : 12.26–8. **Taper tables. I. Basswood. II. Elm. III. Oak, Red and White. IV. Sugar Maple. V. Yellow Birch.** *Tech. Notes Lake States For. Exp. Sta.* No. 198A–E, 1943. pp. [5].

In estimating timber it is often necessary to know how many sawlogs, box bolts, veneer, or tie bolts of different diameters can be cut from trees of various sizes, and to determine the volume of these products separately. These tables, based on a large number of measurements, give this information for the species named in their titles. They indicate the stem diameter inside bark at regular intervals above the ground. The stem diameters are expressed as percentages of the tree diameter at breast height outside bark.

[735]. 52.43.2 : 53. SORENSEN, C. J. **Board foot-cubic foot conversion values.** *Timberman* 47 (2), 1945–46 (42–3).

For the purpose of comparing log unit values in board feet and cubic feet, the author has prepared an alignment chart, which is reproduced. This is based on the Spaulding Board Foot and Sorensen Cubic Foot log rules for logs 32 ft. long, and enables conversion to be made from dollars per thousand bd. ft. to cents per cu. ft. and *vice versa*.

[736]. 52.43.3. REED, F. C. **A simple method of volume table construction.** With comment by C. Mesavage. *J. For.* 44 (3), 1946 (196–7). [Weyenhaeusen Timber Company, Montesano, Wash.]

This article and the accompanying comment suggest a simple method of constructing volume tables, which has given satisfactory results in the West Coast Douglas Fir region. The volume table, which takes into account variations within d.b.h. classes and taper per log, can be completed within one to three days by measurements in the nearest operation cutting timber similar in species, age, and site to that to be cruised.

[737]. 52.43.3 : 12.26–8 : 52.3 (485). MÅNSSON, H. Studier rörande stamform och kubikmassa hos bokskog. [**Studies on stem form and volume in Beech woods.**] *Svenska SkogsvFören. Tidskr.* 41 (2), 1943 (88–165). [Sw.]

Mensurational data for sample trees from relatively even-aged Scanian Beech stands of high density are analysed in detail. Good agreement was found to exist between Beech-stem curves (with correction for the root swelling) and the Höjer-Jonson Pine stem curve as used in the construction of volume tables for conifers. There was also good agreement between the stem volume of sample trees determined by measurement in sections and that for the same material as calculated by the form–class system. Data from the State forest survey are compared with the author's material and from the combined results a volume table is constructed for more or less closed stands of the Scanian type, indicating total merchantable volume (including branchwood down to 3 cm. in diameter) for diameters of 4–50 cm. and heights of 5–31 m., bark volume per cent., and, for trees 10, 15, 20 . . . (etc.) cm. in diameter, the timber of diameter greater than 5, 7 and 10 cm. in per cent. of the total merchantable volume.

[738]. 52.43.3 : 33.02 (77). GEVORKIANTZ, S. R. **A composite cordwood volume table for pulpwood species in the Lake States.** *Tech. Note Lake States For. Exp. Sta.* No. 241, 1945. p. 1.

[739]. 52.46 : 12.26–8 (54.2). GRIFFITH, A. L. **The efficiency of enumerations. X. Hill Sal (*Shorea robusta*) forest in the United Provinces.** *Indian For. Leafl.* (*Silviculture*) No. 90, 1946. pp. [ii] + 12.

This leaflet deals with the examination of the data of 48,284 acres of hill Sal forest of Haldwani division of the United Provinces. The data is poor for the purpose, as the ultimate units of enumeration are large (about 200 acres each) and in consequence few in number (251). The results of the investigation, however, were substantially the same as those for types previously investigated. [Cf. *For. Abstr.* 7 (Nos. 1432, 2090–2).]

[740]. 52.46 : 01.7. GRIFFITH, A. L. **The efficiency of enumerations. XI. The distribution of the volume figures (continued).** *Indian For. Leafl.* (*Silviculture*) No. 91, 1946. pp. [ii] + 5.

This leaflet is the justification for using certain mathematical methods and applying the normal laws of probability in the examination of the enumeration data which were analysed in Leaflet 90 [see previous abstract].

53. SOLID CONTENTS OF STACKED MATERIALS. REDUCING FACTORS

[741]. 53 : 33.7 : 54. SILVÉN, F. Utbytte av kastved vid upparbetning av långved. [**Yield obtained on converting long cordwood to fuelwood.**] *Svenska SkogsvFören. Tidskr.* 42 (2), 1944 (142–5). [Sw.]

[742]. 53 : 52.43.2 : 54. AARESTRUP FREDERIKSEN, J. Fastmassemaaling af Skoveffekter. I. [**Measurement of the solid volume of primary forest products. I.**] *Dansk Skovforen. Tidsskr.* 27 (12), 1942 (488–518). [Dan.]

Consideration is given to errors arising in the measurement of stacked wood (*a*) by means of the formula: volume = sum of end sectional areas × ½ × length, (*b*) an extension of this method, in which the end surfaces of cleft products are considered as sectors of circles and their area determined from a table arranged by length of radius and chord. The systematic errors for both of these methods appear, on mathematical grounds and from field checks, to lie under 1 per cent. The same also seems to apply to the systematic errors arising in the measurement of timber logs by the mid-sectional-area formula. In practice, errors in representation will generally exceed those in measurement. For field checks it is desirable to measure two stacked cu.m. per felling site or per felling gang, and not less than 10–12 separate cu.m. stacks in all for each assortment to be checked (the requisite number of sample stacks for each assortment, if an accuracy of 1½–2 per cent. is to be attained, is calculated to vary for Danish assortments between 10 and 24). The two stacks per site or gang should represent respectively the better and worse stacks made, but if the stacks made are reasonably uniform, only one average stack need be measured per site or gang. Wood stacked in the round should be measured by method (*a*), cleft wood by method (*b*). The end measurements can be taken alternately on the 'front' of one stack and the 'back' of the next. The measurement takes about 10 minutes per stacked cu.m. Simultaneously a check should be made of the over-all dimensions of the stacks. Check samples of timber logs should be measured in sections, using the mid-sectional-area method.

[743]. 53 : 54 : 32.3 (489). BORNEBUSCH, C. H. Fastmasseundersøgelser af Danske stablede Skoveffekter. Udført i Aarene 1941–1943. **[Investigations on the solid volume of stacked wood assortments in Denmark, carried out in 1941–3.** (With note by C. Schaffalitzky de Muckadell.)] *Dansk Skovforen. Tidsskr.* 29 (6), 1944 (229–50). [Dan.] BORNEBUSCH, C. H. Standartfastmasser [**Standard solid volumes.**] *Dansk Skovforen. Tidsskr.* 29 (11), 1944 (492–3). [Dan.]

Report on an investigation by the State Forestry Research Organization on the variation, by species, districts and assortments, in over-all dimensions and true solid volume of the 'stacked cu.m.' as put up in the forest. The data (7 tables) practically all refer to Beech and Norway Spruce and show that local variations in measure are considerable. The main purpose of the second article is to propose that when conditions are stable again, a representative committee should be set up to recommend standards, to apply to both state and private forest produce, designed to secure the greatest simplicity in practice and the greatest possible uniformity in the solid contents of stacked materials.

56. INCREMENT

[744]. 56. CHRISTENSEN, C. C. Tilvækstprocentberegning. [**Calculation of increment per cent.**] *Dansk Skovforen. Tidsskr.* 25 (8), 1940 (448–55). [Dan.]

Simple curves are given for determining (i) basal-area increment per cent. from diameter in cm. and radial increment in mm.; (ii) height increment per cent. from height in m. and height increment in cm.; (iii) form-factor increment per cent. (positive for Beech and Oak, negative for Norway Spruce), from height, for Beech and Oak of site qualities 2·5 and 2 respectively, and for Norway Spruce of site qualities 2, 3 and 4. Volume increment per cent. is given by the formula $p_m = p_g + p_h + p + \frac{p_h \cdot p_g}{100} + \frac{p_f\,(p_h + p_g)}{100} + \frac{p_h \cdot p_g \cdot p_f}{10{,}000}$, where p_m, p_g, p_h and p_f are respectively the volume, basal-area, height, and form-factor increments per cent. A table is provided for the values of $\frac{p_h \cdot p_g}{100}$, and since the values of the two subsequent terms of the equation can be neglected for practical purposes, it is possible to obtain volume increment per cent. by simple addition of the values read off from curves (i)–(iii) and the table value of $\frac{p_h \cdot p_g}{100}$.

[745]. 56 : 12.25 (489) : 44.3 : 12.21 : 11.48. ABELL, J. Rødgran paa Hvidkilde. En Sammenligning mellem Tilvækstoversigt og bogført Masse. [**Norway Spruce at Hvidkilde. A comparison of increment tables with recorded volume.**] *Dansk Skovforen. Tidsskr.* 25 (12), 1940 (617–33). [Dan.]

A comparison of actual volumes recorded at Hvidkilde with increment tables published in 1919 by O. Fabricius, shows good agreement between the two, and the latter are thus suitable, with minor reservations, for use with Norway Spruce in Fyn.

There is some confirmatory evidence from Hvidkilde that attacks by *Fomes annosus* begin earlier and are more serious on coarse, leached sand than on sands with a higher content of clay particles. [Cf. *For. Abstr.* 8 (No. 680).]

[746]. 56 : 12.26–8 (75 : 76) : 57. BOND, W. E., and BULL, H. **Rapid growth indicates forestry opportunities in bottomland hardwoods.** *Sth. Lumberm.* 172 (2154), 1946 (54–6, 58, 60, 62). [Southern Forest Exp. Sta.]

Data are presented on diameter growth of a number of species and net annual increment of various types, in the bottomland hardwoods of the southern United States [cf. *For. Abstr.* 7 (No. 982)]. It is concluded that proper management would still further increase the already rapid rate of growth. More data are needed in order to work out the principles on which such management should be based.

[747]. 56 : 21.6 : 12.11 : 12.14.6 : 12.25 (494) : 31.2. BURGER, H. Holz, Blattmenge und Zuwachs. VII Mitteilung. Die Lärche. **[Wood, quantity of foliage and increment. VII. Larch.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 24 (1), 1945 (7–103 + plates). [G.g.f.]

A study of (i) some properties of the wood of Larch, (ii) the importance of Larch in forestry and the timber industry, and (iii) weight of crown and of needles, increment and water consumption, based on 100 analyses from several sites in Switzerland.

(i) Values are given for the specific gravity of green and dry sapwood and heartwood, with variations due to elevation and width of annual rings; moisture-content of green and dry sapwood and heartwood, and variations due to specific gravity, age and relative proportions of sap and heart; proportions of wood substance, water and air; shrinkage ratios; variation in bark diameter with elevation (the Control Method estimates the actual wood increment of Larch at 26–40 per cent. too high); percentage of sapwood and heartwood in terms f volume and sectional area of barked trees.

(ii) The variability in the properties of Larch wood is enough to enable it, by judicious selection, to replace almost all native conifers and many exotics for special uses. At present it contributes only 1 or 2 per cent. of the total volume of timber on the Swiss market. In its native habitat, Larch should not be ousted in favour of other species but should be introduced on suitable sites in the submontane region.

(iii) Values are given for crown weight compared with Silver Fir, Spruce and Beech; weight of twigs, proportion of needles and water content in twigs and needles; weight and area of foliage with variation for d.b.h.; needle weight in percentage of twig weight compared with that of Silver Fir; relation between weight and area of foliage and stemwood increment with variations for locality and elevation; water requirement and transpiration value for whole Larch stands compared with those for Spruce, Silver Fir, and Beech stands.

There are 26 tables of numerical data, 40 diagrams and 8 photographs. [Cf. *For. Abstr.* 8 (Nos. 174, 302, 754).]

[748]. 56 : 23.24.3 : 12.25. BURNS, G. P., and IRWIN, E. S. **Studies in tolerance of New England forest trees. XIV. Effect of spacing on the efficiency of White and Red Pine needles as measured by the amount of wood production on the main stem.** *Bull. Vt. agric. Exp. Sta.* No. 499, 1942. pp. 28.

Twenty-eight-year-old White and Red Pine (*Pinus strobus* and *P. resinosa*) grown in plantations spaced 2 × 2 ft. and 4 × 4 ft. were harvested and studied with special reference to the effect of spacing on needle efficiency as measured by the amount of wood produced in the main stem. The average breast-height diameter of the Red and White Pines spaced 4 × 4 ft. exceeded that of those spaced 2 × 2 ft. by 48 and 16 per cent. respectively. Highly significant correlations existed between main stem increments and needle development. The efficiency of the needle surface areas on the 4 × 4 ft. spaced Red and White Pines exceeded those on the 2 × 2 ft. spaced trees by 22 and 16 per cent. respectively. Needle efficiency was much the same for the two species on the narrower spacings, whereas the Red Pine needles slightly outdid the White Pine needles on the trees grown on the wider spacings. The needle surface areas per acre on Red and White Pine spaced 2 × 2 ft. and 4 × 4 ft. were respectively 22 and 41 acres and 14 and 16 acres. *Authors' summary.* [Cf. *For. Abstr.* 8 (No. 241).]

[749]. 56.02 : 11.1. SCHULMAN, E. **The range of ring sensitivity.** *Tree-Ring Bull.* 12 (1), 1945 (5–8).

[750]. 56.02 : 12.14.3. SCHULMAN, E. **Root growth-rings and chronology.** *Tree-Ring Bull.* 12 (1), 1945 (2–5).

The ring chronologies in roots have been very little studied, but the existing literature agrees that one of the outstanding characteristics of root growth is its irregularity. The writer has analysed two root chronologies of Douglas Fir on dry sites, over 500 miles apart, and found them of unexpectedly good value and closely correlated with growth rings in the stems. The second of his examples, from Central Colorado, also shows a striking correlation with records of run-off of the Upper Colorado River, and it seems clear that available moisture is the dominating factor in controlling year-to-year fluctuations in root growth of dry-site Douglas Fir.

[751]. 56.02 : 22.83.2 : 65.1. FOGGIE, A. **On girth increment and age of trees with special reference to management in irregular tropical forest.** *Emp. For. J.* 24 (2), 1945 (176–91).

As some tropical trees show no annual rings, or very indistinct rings of unknown relation to the chronological year, it is difficult to determine the rate of growth. Little work has, so far, been published which deals directly with this question. The results of a study on rate of growth in English woods with a view to developing a technique for tropical conditions are given. A possible technique is suggested of forming a continuous growth curve from the individual curves of various size classes derived from measurements over a period of years, but this can only be done if the dominance category of the individual tree is taken into consideration. The average rate of growth which must be determined for forest management is discussed, and the argument is advanced that in irregular forest it is the average rate of growth of the dominant trees within each size class.

A technique for collecting the necessary data under tropical conditions is suggested. A note is given on correlation of girth at stump and girth at breast height and it is suggested that the same methods would be practicable and valuable in determining the girth above buttresses from the spread of the buttresses in trees regularly buttressed when large.

[752]. 56.3 : 12.25. BRIEGLEB, P. A. **Calculating the growth of Ponderosa Pine forests.** U.S. Forest Service, Portland, Oregon. 1945. pp. 60.

This study employs the Keen tree classification [cf. *For. Abstr.* 5 (108)], and incorporates many of the tables previously published by the author in a Research Note [see *For. Abstr.* 5 (206)]. It presents procedures of growth estimation for application to a wide range of selective cutting. Of necessity the growth and mortality data now available are based largely on records of virgin forests and those only relatively recently cut by the selection method. It is hoped that local studies will be continued, particularly on growth after selective cutting, to provide data that can be applied accurately to specific conditions.

57. DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

[753]. 57 : 22.83 : 24.2 : 64. BORNEBUSCH, C. H. Blandskovens Produktion og lidt om Bonitet. **[The yield of mixed forest and a note on site quality.]** *Dansk Skovforen. Tidsskr.* 26 (6), 1941 (235–8). [Dan.]

A review of the Prussian yield studies published by Wiedemann [*For. Abstr.* 2 (77)] with special reference to the yield of pure Oak and Oak/Beech mixtures. The data show that the yield of Oak/Beech is not higher than that of Oak alone, except possibly in old age, and even then the added yield is not from the more valuable Oak. From the Danish point of view there is no reason to abandon the usual Oak stands with a protective underwood and group admixtures or to modify the Danish practice of heavy thinning. Bornebusch approves of the classification of site quality by values directly expressing the volume increment per unit area; such a classification would be an improvement upon the present Danish classification by height, but its introduction would mean considerable preparatory work before it could be used in practical forestry. [Cf. *For. Abstr.* 8 (No. 198).]

[754]. 57.0 : 12.25 : 21.0 (74.7). COOK, D. B. **Further notes on a Larch plantation.** *J. For.* 44 (1), 1946 (58).

The writer reported in 1941 [see *For. Abstr.* 3 (207)] on the first 10 years' growth of a small plantation of *Larix decidua* in New York State. Remeasurement of a sample plot was made at 15 years. Average d.b.h. is now 4·4 in. Dominants are 40 ft. high and there are enough of them to form the final stand.

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

60.2. *Management of Tree Plantations under Non-forest Conditions*

[755]. 60.2 (54.5). KHAN, K. S. M. **Forest management of canal strips and avenues in the Punjab.** *Indian For.* 72 (2), 1946 (75–8). 6th Silvicultural Conference, Dehra Dun (1945).

Cf. *For. Abstr.* 8 (Nos. 72, 256–7). The area suitable for forest growth on either side of the main lines and branches of the canals of the Punjab is believed to total about 38,000 acres. The predominant species, representing roughly 30 per cent. of the tree growth, are Sissoo (*Dalbergia sissoo*) and Babul (*Acacia arabica*). At present, taking the canals as a whole, the fully stocked area probably does not exceed 20–25 per cent. of the total area suitable for planting. About 60 per cent. of the Babul could profitably be replaced by Sissoo, which is a more valuable species and less liable to damage by lopping.

The greater part of the canal tract lies in the arid zone, but the moisture content of the soil due to seepage from the canals is sufficient, with some exceptions, to support the trees, once they are established, without further irrigation. The future of the canal plantations depends rather upon the protection afforded to them against damage by browsing and lopping. Notes are given on methods of growing Sissoo on high uncommanded areas with an average annual rainfall of 30 in. and more, and on growing Babul on similar areas with an annual rainfall of less than 30 in. For waterlogged ground the best species are *Eucalyptus melanophloia*, *E. microtheca*, *E. rudis*, *E. rostrata*, and *E. tereticornis*.

60.3. *Management of Different Classes of Forest*

[756]. 60.31 : 12.26–8. **Growing Walnut for profit.** American Walnut Manufacturers' Association, Chicago, Illinois. 1945. pp. 12.

The growing of Walnut is recommended to farmers and advice given on sites, planting methods, tending, felling and cross-cutting, so as to get the best possible return. Well drained, moist, sandy or gravelly soils both grow excellent Walnut. Growing in mixture with other hardwoods is recommended.

[757]. 60.31 : 12.26–8 (76.2) : 07.2. MAISENHELDER, L. C. **Bottomland hardwood management studied in Mississippi.** *Sth. Lumberm.* 171 (2153), 1945 (117–21).

A review of research projects carried out or in hand by the U.S. Forest Service at the Delta Experiment Station, Stoneville, Miss.

[758]. 60.31.2 (485) : 35 : 82 : 97.2. PERSSON, E., and BOVALLIUS, R. Virkesförbrukning och dagverksåtgång inom lantbruket. Ett femårssammandrag från ett hundratal hemman inom Gävleborgs län. [**Timber consumption and daily work on agricultural properties. A 5-year summary for about 100 farms in the county of Gävleborg.**] *Svenska SkogsvFören. Tidskr.* 42 (1), 1944 (3–23). [Sw.]

Data are presented, for farms in 6 area classes (minimum 1–10, maximum 201–500 ha., with averages under forest of respectively 7 and 330 ha.), on (*a*) timber production, classified as timber for sale standing or converted, and timber for various categories of uses on the farms themselves; (*b*) daily work, classified as agricultural and forestry work, of men and horses. The results for timber production showed clearly that, contrary to general opinion, the farmers disposed of their timber economically: there was no use of industrial assortments for farm purposes, other than what was consumed for necessary repairs to buildings, and where timber for sale was converted, both large and small farms used current scaling methods and sold their products in the open market. In certain particulars, management was not suitably organized, and, especially for the smaller properties, more collective use of agricultural machinery, and more effective distribution of labour, are desirable. Working time freed from agriculture during the summer months would be of undoubted use for forestry operations best performed on unfrozen or open ground, e.g. soil cultivation for regeneration, drainage, road work, cleanings, etc.

[759]. 60.31.2 (485) : 97.2. TILLANDER, T. Skogsskötseln på studiegårdarna i Norrland. **[Forestry on 'study farms' in Norrland.]** *Svenska SkogsvFören. Tidskr.* 42 (5), 1944 (356–65). [Sw.]

On the intiative of various agricultural bodies and the county forestry boards in the four most northerly counties of Sweden, 24 'study farms' have been constituted by agreement with the owners; on each the entire land use, including forestry, will be the object of studies by specialists in agronomy and forestry to determine the most rational means of improving the economy of the whole enterprise. The 'study farms' must be distinguished from ordinary experimental farms, as the emphasis is on study of the enterprise, including the farmer and his family, as an integrated whole. Only 6 of the farms have no woodland. For farms without woodland the agreements are to last 10, and for those with woodland 20 years, with an option of termination of contract by either party at 5 or 10 years. It is hoped that the farms will develop into models for the region in question. The general lines of silviculture and management envisaged are briefly discussed.

[760]. 60.31.2 (71). RICHARDS, E. S. Les lots boisés de ferme de l'est du Canada. **[The farm woodlots of Eastern Canada.]** National Research Council, Ottawa, Canada. 1939 (reprinted 1944). pp. 131. [F.]

[761]. 60.31.2 (71.4). MORAIS, L. La forêt dans l'économie de la ferme. **[The forest in farm economy.]** *For. québec.* 11 (4), 1946 (285–303). [F.]

A general review of the utility of farm woodlands, intended to demonstrate to the farmer their importance and the necessity of conserving and tending them. The total area of farmland in Quebec Province is 19,172,817 acres, of which 6,224,473 acres are woodland. The average wooded area per farm is 40·2 acres.

[762]. 60.31.2 (73). PRESTON, J. F. **Woodland management in the coordinated farm conservation program of the Soil Conservation Service.** [U.S. Soil Conservation Service.] 1944. pp. 12.

A discussion of the ways in which a soil conservation service can assist farmers in managing their woodlands, and particularly in planning a forestry enterprise in the first place. The author discusses in some detail the factors which have to be taken into account: the farm need of woodland products and of revenue from the sale of surplus products; available labour that might be used in woods operations; protective measures; equipment for handling forest products; accessibility, cost of roads, bridges, etc.; volumes of wood products that could be handled efficiently with available labour and equipment; present condition of growing stock.

[763]. 60.31.2 (74). SHIRLEY, H. L. **The challenge in northeast forests.** *J. For.* 44 (1), 1946 (6–8). [New York State College of Forestry, Syracuse, N.Y.]

The 11 north-eastern states of the United States have about 63 million acres of commercial forest land. The average annual increment for the whole of this area is only 50 bd. ft. and 0·23 cord per acre. Over a large part of this area, forest practice involves nothing more than protection against fire, and this is furnished at public expense. The writer urges that, before owners can be persuaded to manage their forest on sound lines, more knowledge is necessary on what constitutes a good, permanent, income-producing investment in a forest property; what size and age-class distributions are necessary; what markets must be available; how much can be paid for land, growing stock, roads, and other improvements, without over-capitalizing to such an extent that timber yields produce an inadequate return. Until foresters are in a position to give owners this information for the several timber types, their advice cannot be taken with confidence.

[764]. 60.31.2 (76.8). SEIGWORTH, K. J., and ARTMAN, J. O. **Woodland management demonstrations in the Tennessee Valley.** *Sth. Lumberm.* 171 (2150), 1945 (34–5).

Account of a woodland management demonstration programme organized by the Tennessee Valley Authority in co-operation with state departments of conservation and agricultural extension services. [Cf. *For. Abstr.* 7 (No. 2122).]

[765]. 60.31.2 (79.7). ARNST, A. **Private land management possibilities.** *Timberman* 47 (3), 1945–46 (214–7).

An account of the Cowlitz County Farm Forestry project. [Cf. *For. Abstr.* 6 (265).]

61. SURVEYING. MAPPING

[766]. 61.3(95):09.7. Shillinglow, A. W. **The military survey of the forest resources of the Commonwealth territories.** *Aust. Timb. J.* 11 (12), 1945–46 (613, 619).

An account of the Forest Survey being carried out by the army in New Guinea. From a study of air photographs areas are classified into distinct vegetation types and the boundaries of each type transferred to a 1-in. map. The map is also marked (from contours) into 3 slope classes (less than 10 degrees, 10–30 degrees, and over 30 degrees slope). This serves to indicate roughly the areas which will probably be devoted to agriculture, commercial forest, and protective forest respectively, when the country is ultimately developed. The marked map is then forwarded to the Field Survey Company, which can decide from it which areas warrant close estimation, which require only a timber cruise, and which need not be inspected at all. The principal use of air photographs in tropical areas has been found to be in the elimination, without slow and laborious ground work, of those areas which are unimportant for timber.

Average stands carry 4,000 to 15,000 super. ft. log volume per acre. Pure stands of Dipterocarps may carry from 30,000 to 60,000 super. ft. per acre.

[767]. 61.32. Fairbairn, W. A. **Some notes on aerial survey.** *Farm and Forest* 6 (3), 1945 (158–9).

Conditions for aerial photography in West Africa can be perfect at certain times of the year, before and after the rains. The periods of poor visibility during the Harmattan in the north, and clouded conditions in the south, should be avoided. Photographic work should be done in the early morning between the hours of 8 and 10, so that the object is shown in better relief. From recent aerial surveys, the following practical points have emerged. The person who is in charge of the area to be surveyed by air should have as perfect a knowledge as possible of its vegetation and topography, must maintain close liaison with the administrative staff of the air survey, and hold discussions with the pilot and photographer who will carry it out. Wherever possible, a preliminary reconnaissance flight should be made by the pilot and the officer concerned. When operating in open country or over roads, white ground signs can be used; in closed country it is essential to have smudge fires producing good columns of smoke. If the aeroplane is not based in the vicinity of the area to be photographed, meteorological reports may have to be telephoned or telegraphed. For aerial surveys of vegetation, the forest officer should plot a series of species which he knows will be easily visible from the air, and study them on the survey, so that he will be able to prepare a key for later identification and interpretation of the photographs.

[768]. 61.32 : 01.6. **The use of aerial photographs in forest surveys: a selected bibliography.** Allegheny Forest Experiment Station, Philadelphia 7, Pa. 1944. pp. 14 + 5.

[769]. 61.32 (71.4). Barrette, G. La photographie aérienne et les problèmes forestiers d'après-guerre. [**Aerial photography and post-war forestry problems.**] *For. québec.* 11 (4), 1946 (304–11). [F.]

A general review of the advantages of aerial photography in forestry. In Quebec there are about 4·4 days a month or 53 days a year, suitable for photography compared with about 100 days a year in the United States. At present, vertical photographs cost $8 to $12 per sq. mile on a scale of 20 chains to the in., and $15 to $25 per sq. mile on a scale of 10 chains to the sq. in., according to whether the area to be photographed is 100 or 1,000 sq. miles. In the United States it is possible to make photographs on a scale of 1 : 20,000 for about $2.5 per sq. mile, the difference in cost being partly due to the greater number of days of good flying weather available.

64. DESCRIPTION OF SITE. ASSESSMENT OF SITE AND STAND QUALITY

[770]. 64 : 12.19.23 (71.1). **Reports of research standing committees, 1945 [Canadian Society of Forest Engineers]: silviculture.** *For. Chron.* 22 (1), 1946 (73–82).

An index for site quality is being sought in the ground vegetation. In 1944 plots were examined in all age groups of second-growth Douglas Fir. A regular sequence of plant communities was found with change in environment from excessively moist to excessively dry conditions. A provisional classification of the ground cover into 12 vegetational types is being drawn up to express by about 5 forest site types the range in site within the Douglas Fir region. Data to show the correlation with height and volume growth are also being compiled (p. 74). [Cf. *For. Abstr.* 8 (No. 140).]

66. POSSIBILITY. SUSTAINED YIELD. YIELD REGULATION

[771]. 66 (44) : 32.96.4 : 32.95. François, T. Possibilité et production. **[Possibility and production.]** *Rev. Eaux For.* 84 (3), 1946 (117–27). [F.]

The writer draws attention to the striking discrepancy which is often to be found between the estimated possibility and actual yield of French forests. He attributes this partly to the obsession of French foresters with the need for natural regeneration, which causes them often to postpone the exploitation of mature stands because regeneration is not present, when the economic course would be to fell them and then apply artificial methods of regeneration if necessary. The other principal cause of the discrepancy is the inaccessibility of many of the richest forests, especially in mountainous regions where the difficulty and expense of building roads is excessively heavy. He suggests greater use of decauville tracks and cable-ways, which can be readily dismantled after operations are concluded.

[772]. 66 (66.9). Nigeria. **Annual report on the forest administration of Nigeria for the period 1st January 1944 to 31st March 1945.** Govt. Printer, Lagos. 1945. pp. 47.

In the past, management of reserves has been based on the assumption that it was dealing with selection forests. Control of felling was by girth limit, ensuring that only mature or over-mature trees were taken, and postulating that they would be rapidly replaced by trees approaching maturity. The realization that the forests of Benin and Ondo are in fact over-mature, seriously deficient in the middle-aged girth classes, and by no means approaching normal forest, has resulted in a complete change of view on management. To continue the old system would result, in a comparatively few years' time, in a grave shortage of mature timber which would take perhaps 50 years to make up. During 1944, meetings of the timber interests were called and all parties were convinced that it was essential to introduce control of felling by area. Such a step necessitates a reduction in the export trade of luxury timbers in the log. More intensive felling will have to be resorted to and a market found for many secondary timbers hitherto unexploited. The general principles of the plan agreed to are a rotation of 100 years divided into 4 periods of 25 years; the total reserved area should be divided by 100, and this proportion of the forest should be felled annually. All firms or individuals holding timber licences in the reserves, or claiming them in equity should be allowed an annual coupe proportionate to their holdings less 20 per cent. set aside for newcomers. Those that are prepared to invest capital in wood-working plant likely to help them in establishing the secondary timbers on the market are entitled to special consideration (pp. 4, 5).

[773]. 66 (73). Streinz, A. J. **Objective: sustained yield.** *Sth. Lumberm.* 171 (2153), 1945 (177–8). [U.S. Forest Service, Southern Region, Atlanta, Ga.]

The U.S. Forest Service in 1936 initiated a programme of management for sustained yield on 161,483 acres in the Davy Crockett National Forest, Texas. Tables are given showing volume of merchantable trees of sawlog size, volume and growth of merchantable Pine trees of sawlog size in operable stands, and distribution of the volume in merchantable Pine trees by sawtimber size classes on the average acre of comparable Pine stands, in 1936 and 1945 respectively.

67. WORKING PLANS

[774]. 67 (71.1). Gilmour, J. D. **A preliminary essay on some of the principles involved in making forest working plans for the Coast forest district of British Columbia.** [H. R. MacMillan Export Company, Limited.] 1945. pp. 53.

A preliminary attempt at evaluating the factors to be taken into account in making working plans for the forests of the British Columbia Coast area. The argument is illustrated by examples calculated for the period 1945–60. The writer emphasizes that these contain too much guesswork for sound planning, because the necessary exact information is not available, and invites criticisms and amendments from foresters and authorities who have access to the essential data.

[775]. 67 : 60.31.2. Mulloy, G. A. **Working plans for farm woodlots.** *For. Chron.* 22 (1), 1946 (30–1).

The Dominion Forest Service, in co-operation with the Federal Department of Agriculture, has prepared a series of working plans for woodlots on experimental farms and illustration stations in the Maritime Provinces. The preparation of these has brought to light certain differences in definition which have a direct bearing on the method of procedure in calculation of the allowable annual cut. The term 'farm woodlot' is here defined as a small area reserved from cultivation, occupying from 20 to 40 acres of the average farm, from which the farmer cuts his annual supply of fuelwood and other products useful on the farm. The 'farm woodland' is an extensive area of woodland owned by the farmer, which may or may not be adjacent to the farm proper, from which the farmer cuts products such as pulpwood, saw-logs and cordwood for sale. In the one case an annual income in the form of fuelwood is essential, while in the other case big returns from the sale of forest products in one year may be followed by a long interval when nothing is harvested.

Because the farm woodlot will be cut over annually, and because all trees which are defective or likely to die are removed, there should be no mortality, and therefore no difference between gross and net increment. Furthermore, in the all-aged forest produced by selective cutting, the current and mean increment are the same amount and therefore no allowance has to be made for the difference of these two rates of growth. Thus the procedure for determining the permissible annual cut in the farm woodlot is much simpler than that for an extensive woodland where not only the net as opposed to the gross current annual increment, but also the average net growth over the whole rotation, as opposed to the current net growth, have to be determined as the basis of cutting. During the interval in which the farm woodlot (generally understocked) is to be brought to its peak of production, the calculation of the annual permissible cut can be regulated by keeping it lower than the gross annual increment.

It is often not practicable to cut over the entire woodlot for the annual wood supply and, in fact, it is not advisable to do so, with the exception that insect-infested or dying trees should be removed wherever they occur. It is simpler and better to divide the woodlot into a number of compartments of more or less equal area, and cut over one compartment each year, taking therefrom the allowable annual cut for the whole woodlot. It is then allowed to remain undisturbed until all the other compartments are cut over.

The smallness of the area and the condition of stocking prevent the calculation of rotation age and mean annual increment for farm woodlots, but the methods outlined above provide a practical means of regulating the cut on woodlots which are far from normal in both stocking and growth.

7. FOREST ECONOMICS, VALUATION, AND FINANCE

74. VALUE OF THE STAND. VALUE OF THE FOREST

[776]. 74. Vinçonneau, V.-R. L'indemnité de reboisement après un sinistre. **[Compensation for reforestation after a catastrophe.]** *Rev. Eaux For.* 82 (2), 1944 (83–9). [F.]

Many authorities, in order to calculate the compensation for destruction of a forest by a catastrophe, simply add to the value of the damage the new costs of reforestation (by sowing or planting). The writer shows that this results in an error to the advantage of the owner, which grows progressively greater with the age of the stand. The correct formula for calculating the compensation for reforestation is

$$P\left[1-\frac{(1+t)^{n}-1}{(1+t)^{N}-1}\right]$$

where P = expenses of sowing or planting, t the rate of interest, n the age of the woods destroyed, and N the normal age of exploitation. The value of this factor varies between zero and P, being very near to P when $n = 1$, and almost negligible when the damaged woods are on the point of being exploited. The formula is, of course, only applicable to stands which would normally be clear-felled and re-sown or planted.

[777]. 74. NØRGAARD, K. Skovbrugets Formueopgørelse [I.] II. **[Determination of the capital in forestry. I. & II.]** *Dansk Skovforen. Tidsskr.* 30 (10), 1945 (405–9); 31 (1), 1946 (22–41). [Dan.] GRØN, A. H. Skovbrugets Formueopgørelse. **[Determination of the capital in forestry.]** *Dansk Skovforen. Tidsskr.* 30 (11), 1945 (493–7). [Dan.] ELMQUIST, A. G. Skovbrugets Formueopgørelse. **[Determination of the capital in forestry** (With reply by K. Nørgaard).] *Dansk Skovforen. Tidsskr.* 31 (1), 1946 (18–21). [Dan.]

In his first paper Nørgaard refers to the dispute between Bavngaard and Grøn [see following abstract] and claims that neither the capitalized value of probable net financial yields nor the expectation value can indicate the capital currently invested in a forest enterprise or the interest being earned at a given point in time. He protests against the tendency to separate forest economics from other branches of economics and proposes three main categories of capital: (i) Fixed capital [*Anlægsformue*] = the sum of values invested in assets before the latter can function productively, i.e. the value of the land and planting costs (as production begins with the start of the first growth period after establishment). (ii) Working capital [*Produktionsformue*] = the sum of values invested in assets between the beginning of production and the time when the produce could be used economically, i.e. costs up to the production of the first unit of merchantable material (tending costs, part of the primary general costs, plus reasonable interest on the money so far invested in assets). (iii) Liquid capital [*Omsætningsformue*] = the sum of values realizable later from production without impairing the productive capacity, whether such values are realized, accumulated or reinvested to increase production, this category covering the value of standing merchantable growing stock calculated as the current realization value on the stump (gross sale price minus secondary general costs). Together with (iv) Miscellaneous other assets, e.g. the value of roads, buildings, etc., these categories make up the total value invested in the forest. Compared with operating results they show the economic capacity and rate of interest. The fictitiousness of the expectation value, owing to the use of current prices as a basis, is emphasized, and it is claimed that either Grøn or Bavngaard, by counting on future yields could arrive at higher values and higher rates of interest than those given by the method outlined, but these would be speculative values distinct from that of the actual capital. The current capital value and the sale value need not be identical, and whereas the sensible buyer may base his offer on sound speculation, the sensible administrator will work with a capital that he can realize at any time without loss.

In reply, Grøn defines and comments on his own classification of values: (v) Cost value, held to be of historical interest only; (vi) replacement value, of small significance where, as in Denmark, re-planting is obligatory; (vii) realization value, the chief fault of which is that the whole growing stock cannot be realized at a given time; (viii) capital value, which assumes constant annual net yields; (ix) expectation value, which takes account of variation in annual net yields, is based on current prices, and gives expression to the effects of economic forces outside forestry as such. He criticizes Nørgaard's categories as pressing the analogy with industry too far and himself develops alternative analogies. Nørgaard's method in general is taken to be a combination of (v) and (vii). Elmquist's criticism is less specific, but he also assumes Nørgaard's method to be essentially the combination mentioned.

Nørgaard, in turn, re-affirms his wish to show that, despite technical peculiarities, forestry works under the same economic laws as other enterprises, and to express, especially where capital cannot yield interest equal to the general interest for the time and place, the capital actually bound up in forestry. Grøn's criticisms are dealt with seriatim, analogies with industry defended, and the new classification claimed, in view of the annual bringing forward of capital at current prices, to be rather a combination of (vi) and (vii), the objections to use of these values being considered as invalid. The expectation value is regarded as of limited application and as highly artificial in its use of current prices combined with probable future yields. A detailed tabular example is given of the use of Nørgaard's method, based on the definitions as quoted and the following principles: The stand is the unit, with a productive period from establishment to felling. Current annual increment is a true business receipt. If not removed, increment becomes a capital investment, thus all merchantable increment is credited and all merchantable fellings debited to capital and at any time the merchantable volume of growing stock will represent the *Omsætningsformue*. At the end of a rotation, the freed capital is to be represented only by the land and the standing value of the growing stock: planting and early tending costs, etc. [*Kulturværdi og Produktionsformue*] are worked off by amortization over the productive period. Felling, extraction, and secondary general costs are deducted during the construction of the price curve, hence the gross yield [*Driftsoverskud*] is the difference between value of increment and that of primary general costs, and the net yield is obtained by deducting amortization and write-offs from the gross yield. Land value is taken as that of corresponding agricultural land minus the expenses that would be required to bring such forest land into agricultural use. If there is premature realization, e.g. after bad fungus attack or the like, suitable write-offs would be made as in other enterprises. If sold before the end of the rotation, the first owner would claim compensation for the unamortized portion of planting and early tending costs, etc., and, if the mean annual interest had not yet culminated, compensation for the resulting loss of interest.

[778]. 74 : 78 : 95.1 (489). BAVNGAARD, A. Skovens Værdier og Udbytte. [I.] II. **[Forest values and yields. I and II.]** *Dansk Skovforen. Tidsskr.* 30 (4; 10), 1945 (97–125; 410–24). [Dan.] GRØN, A. H. Skovens Værdier og Udbytte. **[Forest values and yields.]** Svar til Skovrider Aa. Bavngaard. **[Reply to Skovrider A. Bavngaard.]** *Dansk Skovforen. Tidsskr.* 30 (5; 11), 1945 (174–182; 498–508). [Dan.] HOLM, J. Skovens Værdier og Udbytte. **[Forest values and yields.]** *Dansk Skovforen. Tidsskr.* 30 (8), 1945 (373–4). [Dan.] ULRICH, N. B. Om Vurdering af Skov. **[On forest valuation.]** *Dansk Skovforen. Tidsskr.* (11), 1945 (489–92). [Dan.]

Polemical. Bavngaard's articles are chiefly intended (i) to defend the capitalized value of the probable net financial yields, with a revaluation every few years, as a simpler and more reasonable basis than expectation value for assessing property tax on forest; (ii) to criticize Grøn's theory of forest valuation and the use of expectation values in certain details; (iii) to point out that ordinary Danish Beech woods carry too high a stocking to pay interest at commercial rates (this largely as a result of inadequate timber prices), and to express fears that Grøn and others are encouraging the demand for the highest possible rate of interest on the forest, irrespective of the latter's value as a capital asset, and are thus favouring measures to decrease the growing stock, e.g. by shortening rotations or using very heavy thinning grades; (iv) to emphasize that maintenance of a high stocking of and timber yield from hardwoods is in the national interest and to suggest that discrimination in favour of hardwoods should be made by the State either by additions to the Forest Law or by tax relief [cf. *For. Abstr.* 8 (Nos. 163, 621–2], the latter method being the preferable one.

Grøn, in his replies, agrees with Bavngaard on the need for tax relief in favour of hardwoods, deals individually with the criticisms and quotes extensively from his own works in support of his claims (i) that Bavngaard has misconstrued them; (ii) that his own professed aim has been to enable a forester to analyse the economic background of any measures contemplated, so far as available data allow, so that free decisions may be taken with a fuller knowledge of what is involved economically; (iii) that he has not advocated the highest possible rate of interest as the goal of management; (iv) that he recognizes the capital value as suitable in certain circumstances.

Bavngaard is also criticized by Holm and Ulrich. The latter stresses the topical nature of the dispute, in view of impending valuations for property tax and valuations in respect of damages connected with the war. In spite of faults, the capitalized value of net yields is usable as a conventional index for taxation purposes and probably no more than that. Ulrich has carried out private checks of expectation values during ordinary valuation work and has, on the whole, found good agreement between theoretical and practical values. He also notes briefly the article by Nørgaard [see preceding abstract] and, while believing Nørgaard's categories of capital to be of no great practical use, reserves criticism pending the provision of a detailed example of their application.

[779]. 74 : 76.1. GRØN, A. H. Generalomkostningernes Behandling ved Skovvurdering. **[The treatment of general costs in**

forest valuation [in the event of expropriation or fire damage].] *Dansk Skovforen. Tidsskr.* 29 (10), 1944 (468–71). [Dan.]

[780]. 74.2. SCHAEFFER, L. Prix de revient et valeur d'attente. **[Cost price and expectation value.]** *Bull. Soc. for. Franche-Comté* 24 (6), 1944 (235–9). [F.]

A comparison is made of three methods of valuing growing stands: (1) the formula of Jacquot, (2) a formula making use of the conception of cost price of the stand, (3) a formula making use of the conception of expectation value of the stand. Using each of these formulae on the same data, he arrives at the figures 4,271, 4,256, and 4,268 francs respectively for the expectation value of the stand. He concludes that, while Jacquot's formula is adequate in many cases, the other two are more satisfactory when it is desirable to analyse forest capital into its component parts.

9. FOREST POLICY

[781]. 9 : 06.2. CHAMPION, H. G. **Forestry in the Food and Agriculture Organization.** *Emp. For. J.* 24 (2), 1945 (131–5).

An account of the F.A.O. conference at Quebec in October, 1945, with a discussion of its recommendations.

[782]. 9 : 06.2. CHAMPION, H. G. **International forestry.** *Wood* 11 (3), 1946 (63–4).

An outline of the way in which international co-operation in forestry and primary forest products may be ensured by centralizing information from all countries on progress and methods, if the recommendations of the Technical Committee of U.N.F.A.O. are adopted [Cf. *For. Abstr.* 7 (Nos. 1458-9)].

[783]. 9 : 06.2. GILL, T. **Forestry joins the United Nations.** *J. For.* 44 (3), 1946 (159-63). [Charles Lathrop Pack Forestry Foundation, Washington, D.C.]

A brief history of the origins and proposed scope of Forestry in the United Nations Organization, by a member of the Technical Committee on Forestry and Forest Products of the Interim Commission on Food and Agriculture. The writer considers the greatest weakness of the Quebec Conference of 1945 to have been the very limited participation by the Latin American countries, and that the two most challenging problems before the new organization are those of the great eroded areas of Asia and Africa and of the undeveloped tropical forests.

[784]. 9 : 06.2. **Report of the first session of the Conference, held at the City of Quebec, Canada, October 16 to November 1, 1945.** Food and Agriculture Organization of the United Nations, Washington. 1946. pp. xxi + 89.

This report contains (1) the reports of the Commissions set up to outline policies, programmes, and organization and administration, respectively for the Food and Agriculture Organization of the United Nations; (2) resolutions and recommendations adopted by the conference of FAO at its first session; (3) budget and contributions; (4) rules of procedure, financial regulations and constitution of FAO. The report of the Commission on policies and programme (Commission A.) largely incorporates the earlier reports of the technical committees [see *For. Abstr.* 7 (Nos. 1458, 1459], and also draws upon the reports on forest conditions in individual countries [see *For. Abstr* 7 (Nos. 2158-2161).]

Amongst the recommendations formally moved by the Conference, were two dealing with the International Institute of Agriculture at Rome (including the Centre International de Sylviculture) and the Comité International du Bois. In the first case it is recommended that the Permanent Committee of the Institute should be empowered to wind up the affairs of the Institute and transfer the library, archives, and property of the Institute to the FAO, which will decide their future location. A similar recommendation is made with regard to the Comité International du Bois, with the further clause, that FAO should carry on such of the activities of the C.I.B. as are consistent with the purposes of the Organization set forth in its Constitution.

90. GENERAL PRINCIPLES OF FOREST POLICY

[785]. 90 (410). **Motion – forestry policy.** *Parliamentary Debates (Hansard): House of Lords off. Rep.* 139 (54), 1946 (479–528).

[786]. 90 (410). Rodger, Sir A. **Sane forestry.** *Timb. Tr. J.* 176 (3628), 1946 (925–6).

The writer urges that more attention should be given by the Forestry Commission to the care and replanting of old woodlands, which are likely to be far more productive than much newly afforested land. He also pleads for more mixtures and cites a successful plantation made in 1912–13 with a mixture of 14 species.

[787]. 90 (410) : 94.3. Robinson, Sir R. **British forests.** *Emp. For. J.* 24 (2), 1945 (136–7).

A brief résumé of recent forestry developments in Great Britain, particularly the two White Papers and the Forestry Act of 1945.

[788]. 90 (41.5) : 09.1. Anderson, M. L. **Forestry in Eire.** *Sylva, Edinb.* No. 26, 1945–46 (21–2, 25).

A short historical account of forestry in Ireland and the aims and activities of the Forest Service.

[789]. 90 (6) : 09.7. Hailey, Lord. **An African survey: a study of problems arising in Africa south of the Sahara.** Oxford University Press. 2nd ed., 1945. pp. xxviii + 1837 + maps + tbl. Price 35*s*.

[790]. 90 (66.4). MacGregor, W. D. **Forest Department, Sierra Leone: statement of policy.** *Sessional Paper* No. 2, 1946. pp. 14.

This preliminary 10-year development plan organizes for the execution of the long-term forest policy with special reference to (*a*) recruiting and training African and European staff; (*b*) constructing access roads to inaccessible forest areas; (*c*) a land utilization survey as a preliminary to forest and soil conservation work; (*d*) development of small sawmilling enterprises for supply purposes and as a practical demonstration to the local population of the direct utility of forests. It is held that Sierra Leone is, or should be, predominantly a tree-crop country with rice cultivation confined to flood plains and valley bottoms, and strip farming to the lower slopes. These natural rice areas should produce sufficient rice to feed the entire population, and during the rehabilitation period the farmers withdrawn from rice cultivation in the uplands should be absorbed into other work, e.g. road construction, building, upland conservation, sawmilling, etc.

It has been authoritatively stated that the forest reservation target under West African conditions should be 25 per cent. of the land area; as yet, rather less than 3 per cent. of the total land area in Sierra Leone is reserved. The total high-forest area (reserved and unreserved) is estimated at 640,000 acres, of which 500,000 acres can be regarded as potentially merchantable. The annual increment of immediately merchantable species is conservatively estimated at 10 cu. ft. per acre, and the total annual minimum availability is therefore 5 million cu. ft. Under proper management and silvicultural treatment this could be greatly increased. *Per capita* consumption of wood (other than poles and firewood) was estimated before the war at 0·125 cu. ft. sawn timber, or 0·25 cu. ft. in the round. This is a very low figure (the comparable figure in the West Indies is about 4 cu. ft.), and a very large increase must be expected.

If this 10-year plan is sanctioned it should be financed by a block grant disbursed in annual instalments submitted as estimates. To finance forest conservation and development, £96,000 over and above the existing level of expenditure is needed; for forest industries, £100,000 is proposed, 40 per cent. capital expenditure and 60 per cent. operational costs.

[791]. 90 (67.6) : 09.4. Graham, R. M. **Forestry in Kenya.** *Emp. For. J.* 24 (2), 1945 (156–75).

The writer considers first the necessity of forest reserves in Kenya for purposes of soil and water conservation and for economic reasons. At present there are some 3,750,000 acres of reserved forest in Kenya, which is rather less than 3 per cent. of the area of the country, or 8 per cent. excluding the sparsely inhabited deserts. This should be raised to 5 million acres or more by taking in the remaining unreserved forests on Crown Land and considerable areas of native lands at present almost treeless. At the end of 1943 66,549 acres of plantations were on the Kenya Forest Department books, i.e.: Cedar (*Juniperus procera*), 15,024, other indigenous timber, 8,225; exotic softwoods (mainly Cypress), 17,484, exotic hardwoods, 7,941, and fuel species 17,875 acres. It is probable that at least ½ million acres of the present reserves will be found to consist of reasonably accessible land on slight slopes, suitable for the growth of exotic softwood plantations. Another million acres or so on steeper slopes where much of the best timber grew in the past, could be treated by the introduction of exotic softwoods into poorly stocked forest; the trees should be planted in such areas in small groups over a period of years, under the relatively light shade of the residual stand.

The second part of the article deals with working plans (which have hitherto been practically unknown in Kenya), research, surveys and roads. Part 3 deals with silviculture, mainly of Cypress. [Cf. *For. Abstr.* 7 (Nos. 198, 1703).]

[792]. 90 (73). MARSH, R. E. **Forest Service program for 1946 and the years ahead.** *J. For.* 44 (3), 1946 (186–90).

The writer, the Assistant Chief, U.S.D.A. Forest Service, summarizes the Forest Service programme under four main heads: public aids and services to private owners, public regulation, expansion and development of national forests, and a forest-works programme of capital improvement.

[793]. 90 (76.8) : 60.31.1. SETSER, A. L. **Forest development program for TVA lands.** *Sth. Lumberm.* 171 (2153), 1945 (212, 214, 216–8).

The Tennessee Valley Authority has acquired about 400,000 acres of forest land, primarily for purposes of flood and erosion control, water conservation, power development, etc., which is also used for recreational purposes, and for demonstrating good forestry practice in cutting and management, fire protection, etc.

[794]. 90 (86). GONZÁLEZ, A. Evolución de la politica forestal. **[Evolution of forest policy.]** In *Problemas Forestales de Colombia.* Departamento de Tierras del Ministerio de la Economia Nacional, Bogotá. 1945 (15–42). [Span.]

A brief review of the functions and policy of the Colombian Division of Forestry (Sección de Bosques) from its formation in 1936 until the end of 1939, and a more detailed account of developments since 1940.

[795]. 90 (91.4). PRICE, H. A. **Philippine forestry and the Japanese occupation.** *J. For.* 44 (4), 1946 (272–5).

A member of the American occupation force describes some of the major aspects of Philippine forestry and forest exploitation before, during, and after the Japanese occupation. Repair of the damage done by the Japanese will be slow but is well under way.

[796]. 90 (92 : 91.1 : 91.2 : 95). KOPPEL, C. VAN DE. **Forestry in the Outer Provinces of the Netherlands Indies.** In *Science and Scientists in the Netherlands Indies.* Board for the Netherlands Indies, Surinam and Curaçao, New York City. 1945 (217–22). *Repr.* from *Bull. colon. Inst. Amst.* 2, 1938 (33–44).

[797]. 90 (94) : 09.7. LANE POOLE, C. E. **Forests and forestry in Australia.** *J. For.* 44 (3), 1946 (164–8).

An outline of the history and extent of Australia's forest resources. The prime forest estate is only 10½ million acres, on which production is only one-sixth of what it might be were the forests properly managed. The principal needs of forestry in Australia at present are (1) modern fire protection, (2) great extension of softwood plantations, (3) revision of the timber tariffs to permit the import of softwoods and so reduce the over-cutting of native hardwoods. There is need for more trained foresters. *From author's summary.* [Cf. *For. Abstr.* 8 (No. 811).]

91.1. *Rural Preservation. Reserves. National Parks*

[798]. 91 (73). FRITZ, E. **A proposal for reorganizing and realigning federal forest, forage, park, and game lands.** *J. For.* 44 (4), 1946 (278–81). [Univ. of California, Berkeley, Calif.]

The writer puts forward a plan for reorganization, entailing the creation of a new department under a secretary of cabinet rank to administer all federal forest, forage, park and game lands and Indian reserves in the United States. He further suggests realignment of boundaries of the present national forests, parks, game reserves and grazing districts on a functional basis, and the setting-up of research and education bureaux in the new department.

[799]. 91.1 (73) : 06.1. BUTCHER, D. **National Parks Association.** *J. For.* 44 (3), 1946 (184–5). [National Parks Association, Washington, D.C.]

The National Parks Association was established in 1919 for the purpose of defending the American National Parks against threats from commercial exploitation (grazing, mining, cutting timber, hydroelectric schemes, unnecessary roadbuilding, introduction of artificial amusements), and also from the inclusion of areas containing important resources that will be needed for future economic use, or which fall short of the high standards of the existing natural primeval parks. The writer, who is executive secretary of the association, gives an account of some of the projects which it has furthered or opposed in the past, and at the present time. The association is promoting the establishment of the proposed Everglades National Primeval Park in Florida.

91.4. *Value of the Forest in Hygiene and Recreation*

[800]. 91.4 : 23. Vaissière, J. de. Le traitement de forêts de chasse et de promenade. **[The management of forests for sport and walking.]** *Rev. Eaux For.* 84 (2), 1946 (61–74 + plates). [F.]

The use of forests primarily for purposes of sport (hunting and shooting) and walking involves special problems of management. The writer illustrates these from the Forests of Rambouillet and St. Germain near Paris. Both of these have now reached a stage of development where active measures are necessary to ensure their regeneration, the principle obstacle to which is the abundance of rabbits. The article outlines a scheme of regeneration and improvement cuttings combined with closure for a period of 15 years and artificial regeneration where necessary, the area in closure at any one time being about one-sixth of the whole. The species generally recommended are Oak and Beech, with Scots Pine and *Pinus laricio* in equal mixture where the soils are too degraded to grow hardwoods. The coniferous plantations will be bordered by firebreaks of deciduous species.

[801]. 91.4 (62.4) : 13.2. Bloss, J. F. E. **The tsetse fly in the Sudan.** *Sudan Notes* 26 (1), 1945 (139–56). O.G.

A general account of the incidence of tsetse in the Sudan and of control methods. A block scheme of control on the Yubu River is described in some detail. The river and its main tributary were divided into blocks and each block into sections, all separated by barrier clearings. Paths are cut along either side of the river as close to the water's edge as possible. These paths go up and down all the tributaries as well as along the main stream itself, and are regularly patrolled by fly-boys. As a result of this scheme, incidence of trypanosomiasis fell from 60 new cases in 1939 to 2 new cases in 1942. Another experiment with 'rod' clearings along the river banks is described. Further experiments are being made with a combination of 'rod' clearings and screens, which seem likely to form an effective barrier to fly movement.

91.5. *Value of the Forest for Colonization*

[802]. 91.5. **Population for forests and forests for population.** *Emp. For. J.* 24 (2), 1945 (138–40).

The writer reviews some recent articles on forest colonies [cf. *For. Abstr.* 6 (122), 7 (Nos. 488, 495, 999)]. The necessity of making a thorough survey of resources and drawing up a plan of management before a settlement is established, is emphasized. The settlement must be of the right size and type to carry out the work laid down in the working plan and its size must be rigidly controlled. While lumbering or pulpwood extraction are being carried out on a large scale, as in Canadian forests, the felling series may have to be large (e.g. as much as 800 sq. miles). Part of the scheme of settlement in such an area would be the provision of communications between the felling areas and the settlement centre.

The second problem discussed is that of providing forests to supply villages with wood for building, tools and firewood, and particularly the creation of communal forests in India [cf. *For. Abstr.* 6 (267)]. Finally comment is made on a scheme for community forests in Australia [see *For. Abstr.* 8 (No. 811)] and it is suggested that the establishment of small municipal forests on waste land on the outskirts of English towns would be very beneficial in increasing general knowledge of, and interest in, forestry in England. [Cf. *For. Abstr.* 7 (No. 2153).]

91.8. *The Forest as a Source of Employment and Income*

[803]. 91.8 (73). **Careers in forestry.** *Misc. Publ. U.S. Dep. Agric.* No. 249 (revised), 1945. pp. 23.

A short account of forestry as a profession in the United States: the training required, schools providing it, nature of the work, and various fields of employment (Federal and State forest services, community forest, private forestry, trade and conservation associations, teaching).

92. FOREST LAW

[804]. 92 (410). Great Britain. **Forestry. A Bill to make provision for the reconstitution of the Forestry Commission and as to the exercise of the functions of the Forestry Commissioners, the acquisition of land for forestry purposes and the management, use and disposal of land so acquired; and in connection with the matters aforesaid to amend the Forestry Acts, 1919 to 1927, and certain other enactments relating to the Forestry Commissioners.** H.M. Stationery Office, London, 1945. pp. 12.

[805]. 92 (44) : 96. Groult, P. Sur le défrichement. **[On clearing.]** *Rev. Eaux For.* 84 (1), 1946 (27–31). [F.]

An attempt to define the meaning of the term 'clearing' (*défrichement*) in the French forest code, and to determine the conditions in which the law forbids it without express authorization.

[806]. 92 (47.1) : 96 : 95.1. Skräpskogsproblemet i Finland. **[The problem of devastated and ill-managed forest in Finland.]** *Svenska SkogsvFören. Tidskr.* 42 (2), 1944 (170–4). [Sw.]

Productive forest land bearing unsatisfactory forest and in private, company or communal ownership, is classified (1943) by area in thousands of ha. as (*a*) in need of regeneration 2,035, and (*b*) in need of improvement fellings 2,543, thus totalling 4,578,000 ha. or 35·8 per cent. of the total forest area for the ownership categories named. Since the war-time fuel difficulties created a favourable opportunity for a programme of improvement, a law was passed on 22nd October 1943, the chief provisions of which are: (i) The District Forestry Boards are responsible for seeing that the prescribed fuelwood fellings are made so far as possible in areas needing regeneration or improvement; have power to decide the form and incidence of such fellings and to obtain authority for compulsory fellings if the owner fails to comply; are responsible for seeing that the regeneration or other work is in fact carried out. (ii) Where compulsion does not have to be applied: (*a*) costs may be defrayed from public funds, though the owner must meet the costs of protection against cattle and, in certain cases where he may obviously be expected to do so, may be required to meet other costs in part or in full; (*b*) the yield from the land in question shall not be reckoned for taxation for a period of 15 years in Uleåborg and Lapland or 10 years in the rest of the country, from the completion of regeneration.

[807]. 92 (489) : 94.3. Kinch, S. Skovene under den nye Skovlov. **[The forests under the new forest law.]** *Dansk Skovforen. Tidsskr.* 28 (2), 1943 (37–58). [Dan.]

[808]. 92 (489) : 94.3. Kinch, S. Skovloven. Kommentar til Lov Nr. 164 af 11. Maj 1935 om Skove. **[The forest law. Commentary on Law No. 164 of 11 May 1935 on forests.]** *Dansk Skovforen. Tidsskr.* 29 (10), 1944 (369–462). [Dan.]

Texts of, and commentaries on, the Danish forest law of 1935 [summarized in R. S. Troup's '*Forestry and State Control*', Oxford, 1938], various supplementary instructions, and extracts from other relevant laws. There is a subject index.

[809]. 92 (73) : 22.12 : 12.25. **Origin and results of the seed-tree experiment with Norway Pine on the Chippewa National Forest.** *J. For.* 44 (3), 1946 (178–83). [Yale School of Forestry, New Haven, Conn.]

The Morris Act of 1902, providing for seed-tree cutting and slash disposal on what is now the Chippewa National Forest, was the first attempt at silvicultural legislation in the United States. The writer gives an account of the events leading up to its passage and presents the views of several prominent foresters on its results.

94. FOREST OWNERSHIP. CO-OPERATIVES

[810]. 94 (76.3) : 60.31. Folweiler, A. D. **Forest land ownership in Louisiana and its influence on timber production.** *Bull. La. agric. Exp. Sta.* No. 377, 1944. pp. 56 + tbls. [Louisiana Agricultural Exp. Sta.]

Private owners hold most of the forest land in Louisiana, only 12 per cent. of it being in public ownership. The average area held per owner in the nine parishes intensively studied, was 150 acres in the Loblolly/Shortleaf Pine type, 213 acres in the Longleaf/Slash Pine type and 630 acres in the bottomland hardwoods. A system of Forest Conservation Districts, comparable in operation to the soil Conservation District is suggested as a means of getting owners to maintain the productivity of forest land. Much of the cut-over area of Longleaf/Slash Pine type will have to be replanted if it is to continue to produce timber, and it is suggested that the State might lease such land from the owners, who will wish to retain the title mainly for the sake of mineral rights.

[811]. 94.12 (94). HENDERSON, J. **Community forests for Australia.** *Emp. For. J.* 24 (2), 1945 (205–13).

The need of afforestation in Australia, both for purposes of soil and water conservation and for economic reasons and amenity is stated, and it is argued that the requirements could be best met by the creation of community forests. Some account is given of European and American community forests. The writer considers that the necessary preliminaries to the creation of such forests are (1) the creation of a Commonwealth Forestry Service, (2) State legislation enabling local authorities to acquire land, plant, and exploit it. These lands should be permanently dedicated for forestry purposes and should be situated as near as possible to the community owning them. They should be managed locally, either by the Council concerned, or preferably by a special committee appointed by the Council and advised by the local State Forestry and Soil Conservation Officers. Initial expenses should be met by the imposition of a local rate. When the initial expenses have been paid off, and due provision for the upkeep and possible extension of the forest has been made, the profit from the sale of the forest products should be handed over to the local governing body to be used for such purposes as it may decide. The areas acquired should be exempt from local rates and other taxes, and the income from the forest should be tax-free. An additional advantage from such community forests would be that they could use comparatively small areas of land which cannot be economically afforested by State Forestry Departments. [Cf. *For. Abstr.* (Nos. 797, 802).]

[812]. 94.3 (47.1 : 489 : 485) : 94.4 : 81. BJÖRKHEM, K. E. Organisationsformer för privatskogsbruket i Finland och Danmark. Några reflexioner över motsvarande svenska förhållanden. **[Forms of organization for private forestry in Finland and Denmark. Some reflections on the corresponding Swedish conditions.]** *Skogen* 33 (5), 1946 (77–81). [Sw.]

In both Finland and Denmark private forestry is encouraged by State assistance to local forest owners' associations (the Local Forestry Associations in the former, and the Associations of Forest Smallholders in the latter country). Such bodies are formed on a voluntary basis and employ trained foresters to whose salaries the State contributes. Results have been very good; the chief advantages are continuity of management of woods in a single district by one or two trained men, whose experience becomes of cumulative value, the direct responsibility of such foresters to the owners, opportunities for personal contacts, and hence maintenance of the owners' interest in the proper management of their woods. In both countries legislation to continue and extend this type of encouragement is envisaged. The system in Sweden, on the other hand, is based on State and semi-State organizations, which are less likely to offer the particular advantages listed. In the author's view there would be room in Swedish forestry—particularly in farm forestry—for organizations on the same lines as those in Finland and Denmark.

[813]. 94.3 (73). RECKNAGEL, A. B. **The need for regulation of forest practices on private lands.** *J. For.* 44 (4), 1946 (282–4).

The writer believes that proper forest management cannot be achieved by legislation, and such public control as may prove necessary should be exercised by the states rather than by the federal government.

[814]. 94.4 (54.5). SINGH, C. H. **Forest societies in the Kangra district.** *Indian For.* 71 (9), 1945 (293–7). [Kangra Forest Societies Division, Punjab.]

An account of the origin and functions of the Kangra Forest Societies Division, Punjab. Chiefly in order to check further excessive erosion and land denudation, the Government in 1939 inaugurated a scheme whereby the management of all government forests within each village estate is to be undertaken by registered co-operative village societies on the condition that these societies agree to manage the remaining unmanaged forests under a regular working plan. All reserved, demarcated protected, undemarcated protected, delimited protected, unclassed and *ban muafi* forests within a specific area, plus any land under private ownership which the owner might wish to entrust to the management of the society, form one economic unit to be administered as a society forest estate for the benefit of the village community. The cost of preparation of the working plan and the original demarcation of the forest is borne by government, while the societies are responsible for all protection and expenditure on works required for the conservation of the forests. From a financial point of view the societies are divided into two categories: (1) paying societies, which get sufficient sustained income from the forests to meet their own expenditure; and (2) non-paying societies whose income is less than expenditure. Paying societies are allowed annually to distribute the net profits among their members in equal shares. After five years, however, they must contribute 10 per cent. of the net profit to the government to cover inspection costs.

The transfer of management of government forests to the societies is subject to certain limitations including the retention by government of the right to ownership of land or trees in accordance with current forest and revenue settlements and to extract resin from trees which are government property.

Initial opposition to the scheme has now largely subsided and it is generally regarded with favour. Up to 1st April, 1945, 70 forest societies had been formed, embracing an area of 109,809 acres, but owing to shortage of gazetted staff to prepare working plans, only 40 societies having an area of 43,750 acres have been entrusted with management. Government has established nine forest nurseries in the district to supply the societies and to encourage plantations on privately owned waste land.

[815]. 94.4. (79.5) : 66. **Siuslaw master forest plan.** *Timberman* 47 (2), 1045–46 (78, 80).

Plans are being considered for bringing more than 8 million acres of private and federal land in the Siuslaw basin of Oregon under a single management plan for sustained-yield forest. Under the proposed agreement, each co-operator will undertake to manage his forest land within the unit in accordance with the sustained-yield plan for the unit, to dispose of his timber first to producer co-operators, and to permit the use by any other co-operator of any part of the road system controlled by him. The producer co-operator will obtain his timber supply first from timber available from lands within the unit.

95. FOREST TAXATION. LOANS AND INSURANCE

[816]. 95.1 (410). Gardner, R. S. **The agricultural landowner's handbook on taxation: a guide to law and practice in England and Wales.** Central Landowners' Association, 58 Victoria St., Westminster, S.W.1. 7th ed. (revised and enlarged), 1946. pp. 348. Price 8*s*. 6*d*.

[817]. 95.1 (485). Olhammar, G. 1936 års kommunalskatteberednings förslag angående skogens beskattning. **[The proposals of the 1936 Communal Tax Committee regarding forest taxation.]** *Svenska SkogsvFören. Tidskr.* 42 (3), 1944 (219–36). [Sw.]

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

[818]. 97.2 (66.9). Adelodun, M. **Shifting cultivation in Ilorin.** *Farm and Forest* 6 (3), 1945 (160).

As a result of shifting cultivation, only relicts of the original high forest remain in the emirate of Ilorin, and these are constantly cut over. It is urged that conservation measures should be taken, that mixed farming should be enforced, and the extensive old fallow lands in the relicts of high forest should be reserved.

[819]. 97.2 (73). Preston, J. F. **Lessons from the farm forestry projects.** *J. For.* 44 (1), 1946 (9–12). [Soil Conservation Service, Washington, D.C.]

Farm forestry demonstration projects were handled by the U.S. Soil Conservation Service for the six fiscal years 1940–45. In this article the writer summarizes the conclusions which have been drawn from this experience, on the question how to interest farmers sufficiently to make them undertake a farm woodland enterprise. It has become increasingly, clear that farm forestry is a farming problem and must be integrated with the general programme of farm work if it is to be permanent and successful.

FORESTRY THE WORLD OVER

References: 1. *Bi-monthly Report of Forest Insect Investigation*, Ottawa. 2. *Brasil madeireiro*, Rio de Janeiro. 3. *Foreign Commerce Weekly*, Washington. 4. *Pulp and Paper Magazine of Canada*, Montreal. 5. *Revue des Eaux et Forêts*, Paris. 6. *Technical Notes, Division of Wood Technology, Forestry Commission, New South Wales.* 7. *Timber*, Ottawa. 8. *Timber of Canada*, Ottawa. 9. *Timberman*, Portland, Ore. 10. *West Coast Lumberman*, Seattle. The numbers in brackets indicate the reference number and the date of publication of the periodicals, etc. to which the annotations refer.

Australia. The Forestry Commission has made a preliminary survey in the North Coast Districts of New South Wales, to determine the extent of the occurrence of *Melaleuca alternifolia* and *Leptospermum citratum*, which contain valuable essential oils used in medicine and perfumery respectively. The objects of the preliminary survey included the establishment of a satisfactory technique for sampling the species in order to obtain data on oil yield and type. More detailed surveys will be made later in the year (**6**; Jan. 1946).

The timbers of Brush Box (*Tristania conferta*) and Turpentine (*Syncarpia laurifolia*) are very difficult to distinguish even with microscopic examination. It has been found that solutions made by boiling shavings of Brush Box and Turpentine in water reacted differently when tested with a solution of ferric chloride. This iron salt gives a black coloration in the presence of tannins, and a few drops of 3 per cent. solution of ferric chloride gave a heavy black colour with the Turpentine extract and a light greenish-black with Brush Box. When a drop of the ferric chloride solution was placed on a freshly planed surface of the timber itself, similar results were obtained. Subsequent tests with marine piling proved this to be a simple and reliable test for differentiating the two species (**6**; Jan. 1946).

Bolivia. Surveys indicate that Bolivian forests could provide sufficient types and amounts of lumber to meet all domestic demands and have an exportable surplus of certain species. Plans are under way to install a small sawmill near the new Cochabamba-Santa Cruz road, and a larger sawmill near Santa Cruz, with Government funds (**3**; 4.5.46).

Brazil. Owing to the over-exploitation of Peroba Rosa (*Aspidosperma* sp.) in the State of São Paulo, the Instituto Nacional de Pinho recommends the use of other equally suitable species to replace its present exclusive use for building construction in São Paulo. Timbers not naturally so durable can be improved by preservative treatment. Artificial plantations will have to form the basis of future timber economy (**2**; March 1946).

A wood-distillation plant established at Piraquira, Parana, Brazil, has a monthly capacity of 4,000 litres of methanol. Other materials produced by the plant include acetone, acetic acid, wood tar, tar oils (including cresylic acid), solvents, and anticorrosive paint (**3**; 27.4.46).

A series of tests are being carried out with a new machine for cracking Babassú (*Orbignya barbosiana*) nuts, which have hitherto been cracked by hand. The machine is reported to have given satisfaction in a trial involving the cracking of 3,000 lb. of nuts, which yielded 221 lb. of kernels, 113 lb. of husks and 120 lb. of meal (**3**; 1.6.46).

Canada. A number of research projects connected with forestry and conservation work are being carried out by divisions of the Ontario Dept. of Lands and Forests. Surveys of regeneration and silviculture are being completed in Temagami, Port Arthur and Kapuskasing districts. Completion of data and reports for 1945 in the Nipigon experiment on budworm control is being hastened, and studies are in progress on mosquito, wood-borer, and sawfly control. A 5-year project has been begun with the object of compiling information on logging costs, which will result in more equitable collection of stumpage dues. Suggestions for an entirely new type of fire-hose have been made to a manufacturer by the research division of the department. A co-operative project between the reforestation and research divisions involves the use of infra-red lamps in extracting seed from cones; the object is a reduction in the bulk of machinery and time required for seed extraction. An entirely new type of tree-planting machine is being developed (**8**; March 1946).

A map of New Brunswick was prepared last autumn by the Provincial Department of Lands and Mines in co-operation with the Dominion Entomological Laboratory at Fredericton, in order to show the nature of the forest and its relative susceptibility to budworm attack. Four classes of susceptibility were set up, based on the kind of information generally available, and the results were checked by examination of the photographs taken in the recent aerial survey of the Province. It is hoped shortly to issue the map with detailed explanation (**1**; Mar.-Apr. 1946).

The Ontario Department of Lands and Forests has made successful experiments in keeping open forest trails and roads by the use of the new weed-killer 2-4-D. Present cost per unit of area weeded works out about the same as other weed killers now on sale, but the price is expected to fall rapidly to a level where this preparation may be of importance in silviculture as well as horticulture (**8**; June 1946).

Answering questions put to him at a forestry staff conference recently, Mr. Ponsford of Sault Ste. Marie outlined some of the uses to which aircraft are or might be put in forest fire prevention. Helicopters, able to ascend and descend vertically and hover over a fire have been considered, but at present they are too expensive, very difficult to operate, and in fact only about 3 men in America to-day are qualified helicopter pilots. Forestry planes are equipped with floats for small-lake landings and it would be too dangerous for men to bail out from them, as at present designed: the men would be sucked in to strike the floats by the propellor slipstream. This difficulty might be overcome by specially designing the plane for the purpose of parachuting. Planes which land on water, take up a fill of 55 gallons of water in each float as they skim the surface under power, with float valves opened and closed hydraulically by the pilot, and then ascend and dive on fires with strong streams are not only practicable, but are actually in use. A Norsman aircraft so equipped was stationed at Temagami, 100 miles north of North Bay last summer (**4**; April 1946).

The British Columbia Forest Service is co-operating with the Department of Transport and the big logging companies in testing a new method of measuring fire hazard with reference to the movement of large air masses. Further research is necessary but it is believed that by this means it will be possible to forecast periods of extreme fire hazard as much as 12 days ahead, which would make it possible to move men and equipment to the danger spots and take other precautionary measures before the fires started (**8**; June 1946).

Warner Bros.' two-reel technicolour film, *Forest Commandos*, was recently shown with great success in Toronto. It includes spectacular shots of disastrous fires which swept the Cochrane district in the spring of 1944. The film is acted entirely by non-professional actors, and depicts the spotting of a forest fire from a tower, the resultant alarm, the loading of aeroplanes, the initial work of fighting the fire, the call for assistance and the arrival of reinforcements (**7**; May 1946).

Until recently, Western Red Cedar [*Thuja plicata*] was regarded as unsuitable for plywood. The Pacific Veneer division of Canadian Forest Products, Ltd., near New Westminster, B.C., are now successfully manufacturing Red Cedar plywood using a slicer previously used for hardwoods. After the logs have been sliced, the veneer is treated with a moisture-resistant glue and then put into a cold press. A circular sawmill flitches the logs for the slicer, which is a 16-ft. unit. The product is excellent for general use in panelling, furniture, walls, etc. (**10**; May 1946).

A lumber firm of Fort William, Ontario, has started to manufacture wood-fuel briquettes from wood waste. The enterprise, the only one of its kind in Canada, produces synthetic fire logs, which are already in great demand. The manufacture provides a use for mixed species of wood in small particles, such as sawdust and shavings (**3**; 18.5.46).

Cuba. Export from Cuba of Mahogany [*Swietenia* sp.], Cedar [*Cedrela* sp.] and Sabicu [*Lysiloma sabicu*] has been prohibited for a period of 5 years in order to conserve hardwoods for domestic manufacturers and to counter high prices resulting from export demand (**3**; 15.6.46).

Denmark. Dr. C. Syrach Larsen recently visited America in order to obtain the best strain of Douglas Fir for introduction into Denmark. The progeny from the seed that David Douglas collected in the 1820's, probably near the old Hudson's Bay post at Vancouver, has been very successful in Denmark, so he took cuttings from this locality as well as from the Wind River and Cascade Head Experimental Forests (**9**; June 1946).

France. An international congress on the rational exploitation and utilization of wood will be held in Paris from 16 to 30 September, under the auspices of the Services de la Production forestière. One of the subjects to be especially considered is the exploitation of coppice for firewood. France at present produces only one-quarter of her pulpwood needs, but has a large surplus of small firewood which could be used for the manufacture of cardboard, etc. The utilization of firewood for charcoal manufacture and modern methods of heating will also be considered (**5**; July 1946).

French Equatorial Africa. The Wood Bureau of French Equatorial Africa, which was created in 1944, has been reorganized and given a virtual monopoly over the sale and export of all forest products. The duration of the Bureau is fixed at 50 years and, in addition to other functions, it acts in French Equatorial Africa as the sole exporter and seller for all foreign markets of all forest products of the colony and the exclusive supplier of woods for local conversion. It has control of all minor forest products including resins (**3**; 27.4.46).

Guatemala. The Guatemalan Government has issued new regulations to govern the public auctioning of contracts for cutting of timber. Invitations for bids to cut timber on nationally owned lands shall be published during the first 2 weeks of January and June of each year, and bidding shall be closed by the end of each of those months. Basic prices for Mahogany, Cedar and other fine woods shall include the following taxes, fees and duties: $2 for each standing tree, which sum shall be used for forestry work; $10 for each standing tree for the national treasury; and the prevailing export duties on timber and forest products in general. Prices for other woods to be cut shall be set in the respective bids (**3**; 4.5.46).

Madagascar. Most of the 1945 production of finished lumber was used locally; a little more than 700 metric tons was exported. The chief woods produced were Ebony [*Diospyros perrieri*], Palisander [?*Dalbergia* sp.], Rosewood [?*Dalbergia* sp.], Sandalwood [*Santalum* sp.], and Mahogany (**3**; 1.6.46).

Paraguay. Production of Palo santo [*Bulnesia sarmienti*] oil has fallen off in recent years. Yields were reported as follows: 4,300 kg. in 1941, 7,235 kg. in 1942, none in 1943, 2,872 kg. in 1944. Palo santo oil has a delicate tea-like odour and is well suited for use as perfumery for soap (**3**; 8.6.46).

Philippines. Many miles of Mangrove forest have been noted recently in the coastal regions of the Philippine Islands, indicating a possible opportunity for development. Extract produced from the bark could be used in the preparation of cattle hides, which in turn could be used by the native shoe industry (**3**; 27.4.46).

Poland. Poland's 1946 paper production is estimated at about 165,000 short tons, which will be utilized by the domestic paper mills. In eastern Poland the wood available is mostly Spruce. Two or three new sulphate mills to make bleached kraft by the Kamyr system are planned for western Poland (Pomerania and Silesia) where pulpwood resources are mainly Pine. Not only new mills, but also old mills which have to be rebuilt, will have facilities for making bleached pulps. A programme of research into paper manufacture is being planned at the University of Lodz (**3**; 4.5.46).

South Africa. Production of turpentine in Tokai, Cape Peninsula, reached 6,000 gallons in 1945. Turpentine from Tokai Pines was especially valuable during the war when imports were limited.

During the past 4 years the tapping of these trees has been part of the work of the Forestry Department at Tokai (**3**; 18.5.46).

Surinam. All sawmills in Surinam are situated at or near Paramaribo, the logs being floated down the rivers to the mills. It is now planned to build a mill in the interior, on the Government railway, about 120 km. south of Paramaribo, and ship the sawed lumber to Paramaribo by rail (**3**; 18.5.46).

U.S.A. The Dow Chemical Co. in Michigan has established a successful process on a commercial scale for coating plant and tree seeds in order to facilitate handling and increase resistance to adverse growing conditions, using a mixture of fly ash and feldspar, with fungicides, insecticides, fertilizers, etc. added. Advantages include bringing small irregular seeds to a size and shape permitting mechanical sowing, reduction of rodent, bird, insect and fungus attack in the seed stage, reduction of damage in the seedling stage through more rapid growth, increased survival of seed sown broadcast on untreated soil (**8**; June 1946).

A new process known as vapour-drying has been developed by the Taylor-Colquitt Co. It involves the exposure of green or partially seasoned wood to inert organic vapour raised to a high temperature in a closed chamber where moisture is rapidly vapourized. Advantages over air or kiln drying methods are reduction of drying time to hours instead of days or months, increased efficiency of the seasoned wood, greater economy, inclusion of a simultaneous preservative treatment. The process is also said to reduce checking, remove resins, and only slightly lower the strength of the dried wood compared with green wood. It is stated that plants may be converted for vapour drying at a reasonable cost. A number of organic 'liquids' are used in the Taylor-Colquitt process, which differs from one developed by the Western Pine Association in that the liquid is not primarily a solvent, but forms a neutral atmosphere in which the wood can be heated without danger of charring. One such liquid is xylene which boils at 280° F. and another is high flash naphtha which boils at 330° F. When lower temperatures are necessary, as in the case of certain woods, or when a plant has limited heat capacity, reduced pressure will lower the boiling point of the drying agent. The final step in the process is withdrawal of moisture and the organic material from the wood by the creation of a vacuum in the drying chamber. The organic liquid can be recovered for re-use (**8**; June 1946).

A new use for Douglas Fir plywood has been developed by the United States Plywood Corporation, Seattle. They are now manufacturing a product called Weldtex Siding for use as weatherboarding. It has a striated finish, with the striations running parallel to the grain, and is made of exterior grade plywood. Weldtex Siding is marketed in panels 48 in. wide, $15\frac{7}{8}$ in. long, and $\frac{3}{8}$ in. thick. It has already been used for some 350 buildings in the State of Washington (**10**; May 1946).

The Du Pont de Nemours Company announces a new wood-base 'foamed' plastic, 'CCA'. This is a cellular cellulose acetate, so light that 4 cu. ft. can be balanced on the fingertips with ease, yet the strength approaches that of structural timber and it is claimed that luggage made with 'CCA' as a core will support a man's weight. When bonded between two sheets of metal, wood or plastic, 'CCA' combines remarkable structural strength with insulation against heat and cold.

Foster D. Snell Inc. of Brooklyn, announce a similar material called 'foamboard'. The raw materials are mechanically foamed in aqueous solution, then dried to become water-insoluble and non-inflammable. The curing process imparts to the glue used high resistance to water, fungi, and other destructive agents. The product is odourless and can be cut with a knife, sawed, and otherwise shaped (**7**; May 1946).

Plans have been completed for initial steps in developing possible large-scale production of high-protein livestock feeds from wood sugars as a by-product of pulping operations. In addition to providing large quantities of badly needed supplementary feed for cattle, poultry, and other farm animals, the plan would substantially reduce stream pollution by pulp mill effluents. Research will be conducted at Oregon State College, Corvallis, Ore. and will include a market study and construction of a pilot plant for production of yeast for test feeding in cattle-raising States of the West. Studies will at the same time be undertaken to determine the toxic effects of dilute kraft mill effluents on fish (**9**; June 1946).

U.S.S.R. Electrification of timber operations is planned in the U.S.S.R. to speed up production, particularly in felling and limbing. Two model saws have been constructed, weighing 13 and 20 kg. respectively. Using the heavier saw, nine men can fell 100-120 cu.m. in one shift. The Timber Ministry hope to fell 6 million cu.m. of timber in 1946 by the use of this saw. In order to supply current for the operation of the saws, it is proposed to build additional 7-15 KW power plants, more than 50 of which are already in operation. Tests are now being made on a small compact machine, weighing between 4 and 5 kg. and powered by a small electric motor, for the purpose of cutting branches (**3**; 27.4.46).

At the Siberian port of Igarka on the lower reaches of the Yenisei river, there is a very large sawmill, working on a 24 hour schedule. Mill and yards cover dozens of acres of ground. Timber is supplied from virgin Cedar, Pine and Fir forests on both sides of the Yenisei and its tributaries, and logs are floated down to the mill. The mill is fully mechanized, steam providing most of the necessary power (**8**; June 1946).